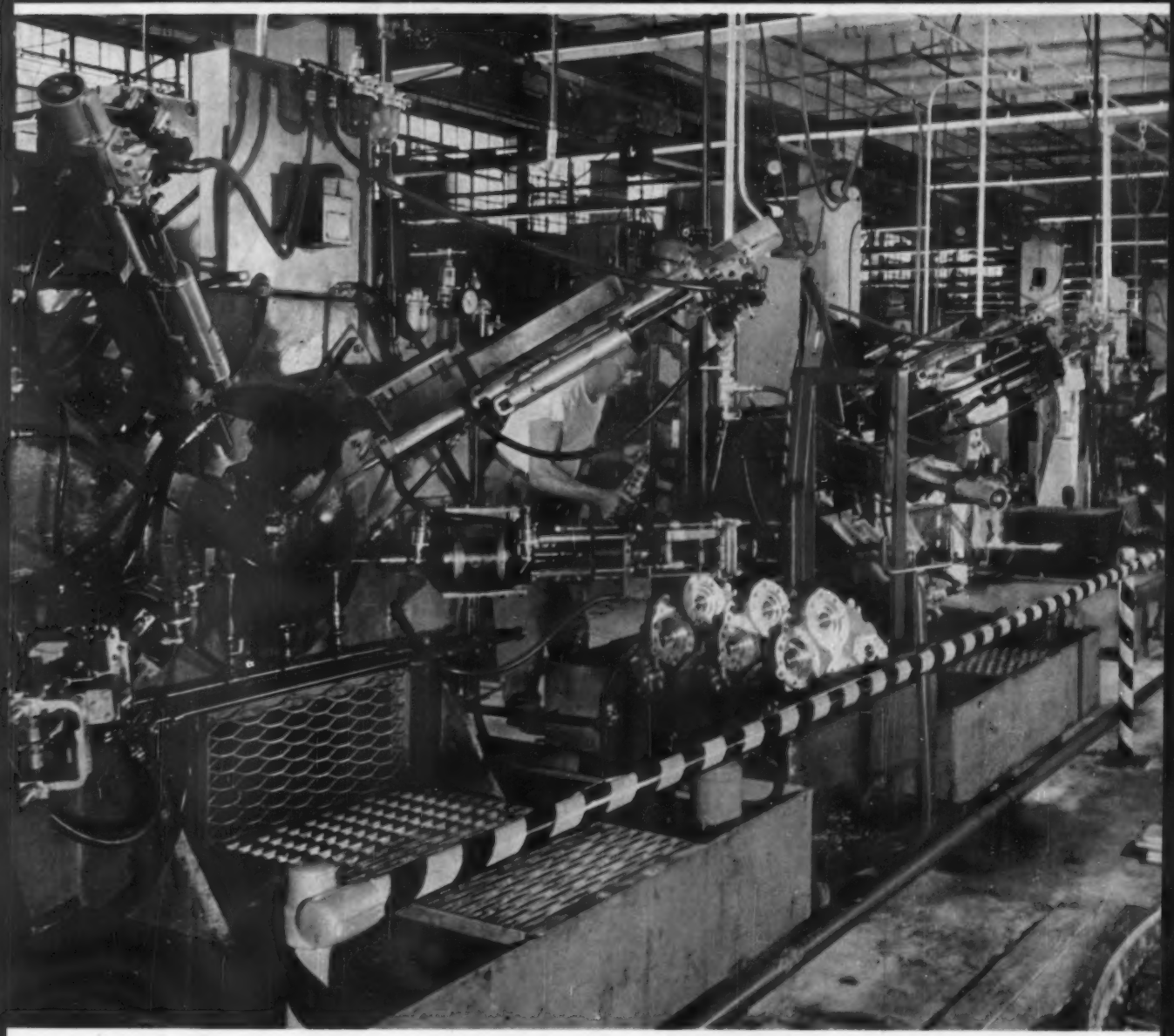
American Machinist

DECEMBER 16, 1957 PRICE 75 CENTS

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Mass-production Missiles

page 105



ycoming gun drills in different directions at once—see page 2

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Here's Why BORE-MATIC VERSATILITY SAVES MONEY on Any Automated Production Line

When the time comes for a job changeover, you can do it at a saving with Heald Bore-Matics

Heald Slide Units Simplify Automation

The Heald *Slide-Unit* is the basic "building block" of an automated Bore-Matic production line. This simple, compact, hydraulically operated unit, complete with boringhead and drive, can be mounted in any position and can approach the work from any angle. It can be tooled for any desired operations — from roughing to precision finishing.

Because each Slide Unit is a separate and completely self-contained machine—arranged through interlocking control circuits to function as a fully automatic segment of the entire production line — individual machines can be added as required.

THE versatility of a Heald Bore-Matic has often been cited in terms of the machine's ability to perform a number of operations simultaneously. But this basic versatility has another advantage—one that is particularly important where large, automated equipment is involved. It *protects your investment* against the danger of early obsolescence!

For example, a Heald automated production line consists of the required number of *basically standard* Bore-Matics — tooled up to perform the required operations on a specific part. The machine becomes "special" only where part design requires it. Upon completion of the job for which the machine was designed, it can usually be re-tooled and put to work on a brand new operation — with a minimum of structural changes. This simplicity and economy of job changeover eliminates much of the "risk" in planning a long-term investment in automated equipment.

If you want a production line that's *protected against obsolescence*, talk to your Heald representative about Multi-Unit Bore-Matics, another example of why *It Pays To Come To Heald.*

HEALD®

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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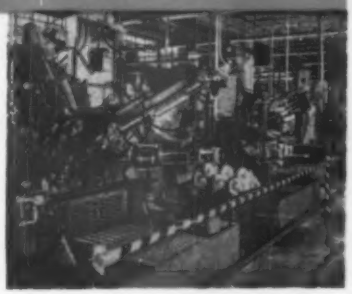
American Machinist chips



Gun-drilling line... Holes for oil lines feeding all main bearings in supercharger rear covers for reciprocating engines are gun-drilled at Lycoming Div of Avco. The holes are 5/32 in. with depths up to six inches and tolerances of ± 15 min. A central high-pressure oil system has a manifold to the five machines in the line. A low-pressure return manifold leads to the filtered sump. A safety interlock automatically retracts drills when oil pressure is reduced below safe level for any reason. In this unusual installation, with gun drills operating in different directions at the same time, as many as 14,000 holes have been drilled without difficulty of any type. Another unusual drill application at Lycoming is the use of dog-leg milling cutters to mill overlapping spots with a Natco multi-drill. The setup is described in the article on page 109.

Missile production... First missile to go into mass production in this country was the Nike-Ajax; large numbers of these missiles have been in the hands of operational units for years. Recently security restrictions were relaxed enough to permit us to visit the two plants established for Nike production. George De Groat covered the plant in Santa Monica, Andy Ashburn went through the one in Charlotte, and they combined their data for our lead article on page 105.

Spending with sense... Nothing is more important to long term success than the right amount of capital investment for the right things. Westinghouse has a 5-year plan that involves no complex formulas to provide "Planned Facilities with Built-in Profits." We think you will find their approach full of ideas you can use. We suggest you give careful attention to the Special Report on this technique, page 137.

And Building Blocks... Since we first reported (*AM*—July 16 '56, p113) the Ford proposals for interchangeable machine components, there has been a rising tide of talk about this controversial proposal. You'll find a summary of the latest developments on page 121.

Coming... *AM* for Dec 30 will include a report on some basic research in grinding stresses, a report on unusual developments in extrusion of rocket tubes, details on how ultrasonic inspection is helping prevent failures in steam turbines, and articles on barrel finishing, reaming, and optical gaging. In the meantime, have a Merry Christmas!

Cover...

Central high-pressure oil system serves five machines, each of which have up to six gun drills for oil holes in. Lycoming reciprocating engines. Details at left.

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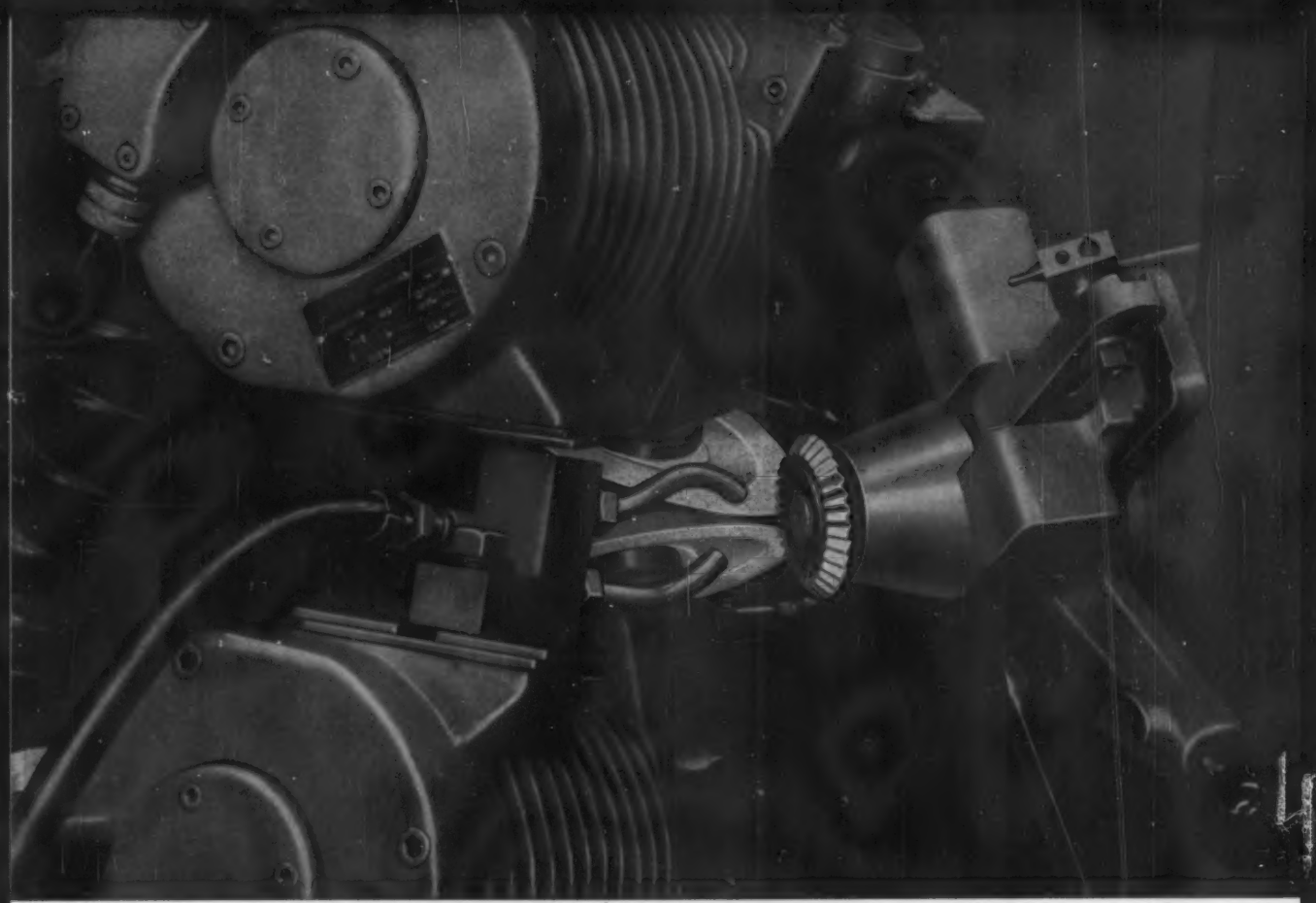


Now you can grind straight bevel Coniflex® gears

You can *now* use hardened and ground straight bevel gears for many angular drives requiring extreme precision and load carrying capacity.

The new Gleason No. 105 Straight Bevel Coniflex* Grinder generates gears with the highest accuracy of spacing and profile, with the tooth profile, fillet radius, and tooth bottom formed into one smooth blended shape by two grinding wheels.

And gears ground on the No. 105 Grinder after hardening *maintain their extreme precision* even under continuous load operation.

Wet-type grinding on this machine provides fast cycles and excellent finish. Set-up calculations are simple. The completely automatic cycle of the No. 105 Grinder not only assures uniformity of production but also provides great savings in time and production costs.

We will gladly send you more information about the No. 105 Straight Bevel Coniflex Grinder upon request.

The No. 105 Grinder accommodates straight bevel Coniflex gears up to 8½" pitch diameter, 3DP with ratios up to 6:1, cone distances up to 4¼". Gears 20DP and finer may be ground directly from the solid; coarser pitches are ground after semi-finish cutting and hardening.

*Straight bevel gears with localized tooth bearing.

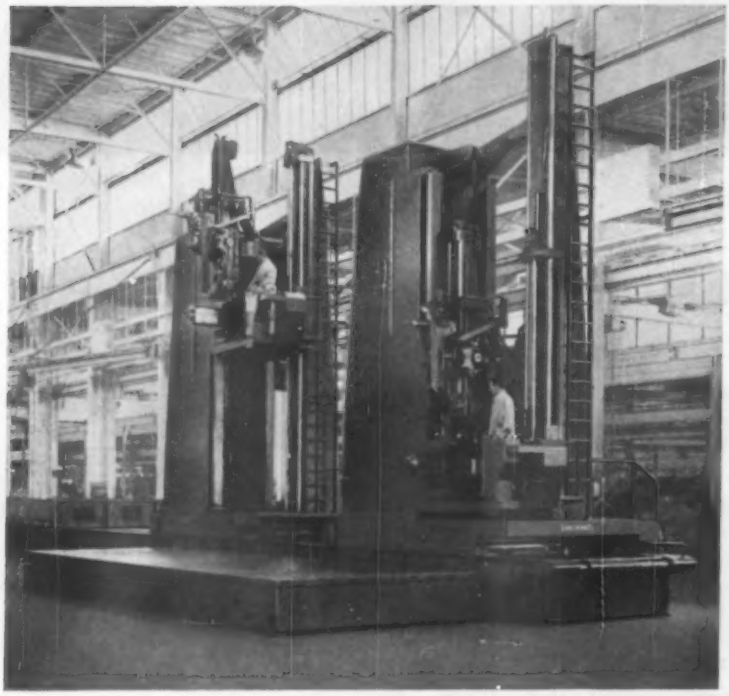
GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

The Finest Machine Tools for Aircraft and Missile

ARE BUILT BY CINCINNATI MILLING



Die cavities in 100-ton die blocks for aircraft forgings are automatically tracer milled on this CINCINNATI Traveling Column Hydro-Tel Milling Machine. Equipment includes two independent cutting heads for machining the upper and lower halves of a die set simultaneously. Capacity: maximum size of die block, 12 feet x 30 feet, weight up to 100 tons. Vertical range of each spindle, 10 feet; longitudinal range of machine, 28 feet.

Progress in aircraft and missile production depends upon advanced thinking and engineering in today's machine tools. Many new Cincinnati Milling Machines, now operating at peak performance in aircraft plants throughout the country, are evidence of Cincinnati's modern design and reliable performance. Cincinnati Milling has the engineering personnel, experience and facilities to build additional machine tools like them, or others completely different . . . operator controlled, numerically controlled, or automated to any degree desired.

Two large CINCINNATI® Milling Machines, built to specifications for prominent aircraft companies, are illustrated here. Many others have been built for producing jet engine parts, wing sections, landing gear and similar components. May we tell you more about our ability to produce machine tools for your present and future requirements? Our engineers will be glad to work with you.

Special Machine Tool Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

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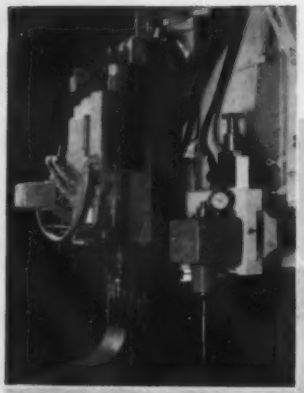
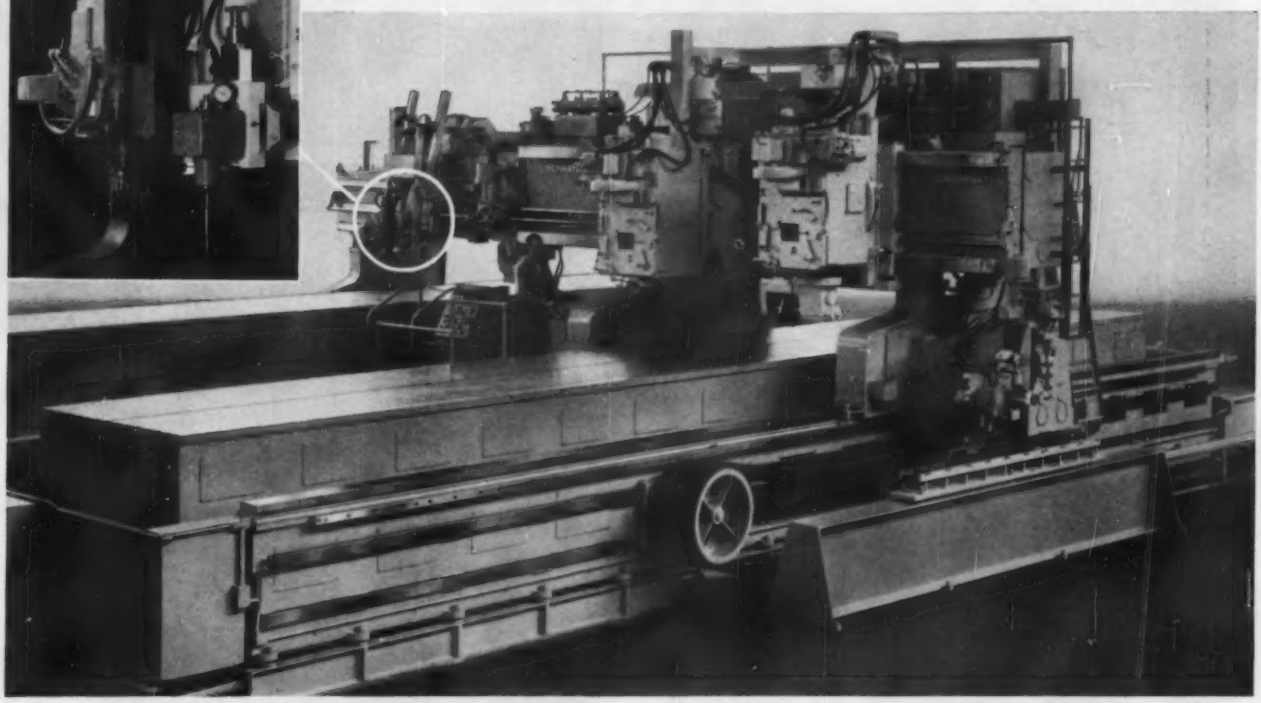
Production



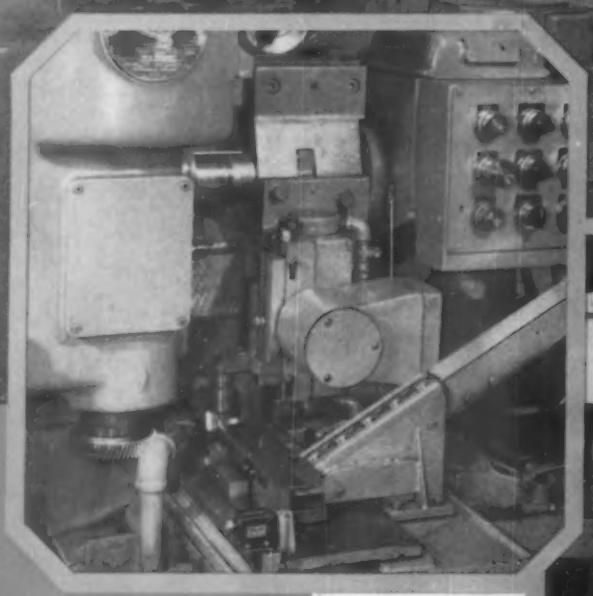
Two automatic tracing units, mounted on the CINCINNATI special aircraft miller illustrated below, are shown in this close-up. Left to right: Line Tracer; Universal Automatic Depth and 360° Combination Tracer.

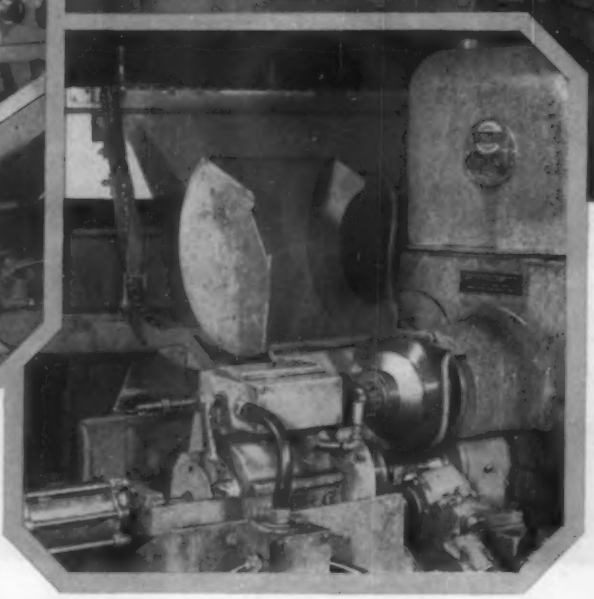


Versatility and productive capacity rate equally high in this CINCINNATI Aircraft Milling Machine. Some of the operations performed by the machine include horizontal and vertical spindle cuts in aluminum, steel or titanium skins; twist milling; line tracing from a drawing; 360° tracing; depth tracing. For "twist" milling operations, the left-hand head swivels 30° right and left while taking a contour cut. Feeds and speeds may be selected to suit the job. Working surface—6 feet x 28 feet; template table—5 feet x 28 feet.

SPECIAL MACHINE TOOLS AND COMPLETE PRODUCTION LINES

THE *FORWARD* LOOK . . .





Fellows No. 4GS Gear Shaper with attachments for full-automatic loading and unloading.

Fellows No. 8 Full Tool Shaver set up for automatic loading and unloading.

THE PRECISION LINE

in Chrysler's Fully-Automatic Gear Production Line

Fully-automatic shaping and shaving on Fellows machines: this is *"The Forward Look"* in gear production techniques, adding advanced speed and efficiency to pinion production for Chrysler Corporation automatic transmisions.

Cutting at a speed of 470 strokes per minute, each of 14 Fellows No. 4GS Gear Shapers rough cuts and finishes a 1.286" P. D. pinion in less than a minute. Parts are then automatically conveyed and loaded on Fellows No. 8 Full Tool Shavers for final finishing. Parts are automatically stock-piled in process to spread production evenly over machines.

These are the same versatile machines that many manufacturers use for manual production of short runs of gears and other shaped parts! Optional attachments provide any degree of automatic operation desired. Ask your Fellows Representative to show you facts and figures on the cost advantages of investment in modern Fellows machines. A 71-page booklet, "The No. 4GS Gear Shaper," describes and illustrates the machine in full detail, including attachments for automatic or semi-automatic operation. Write, wire, or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, New Jersey
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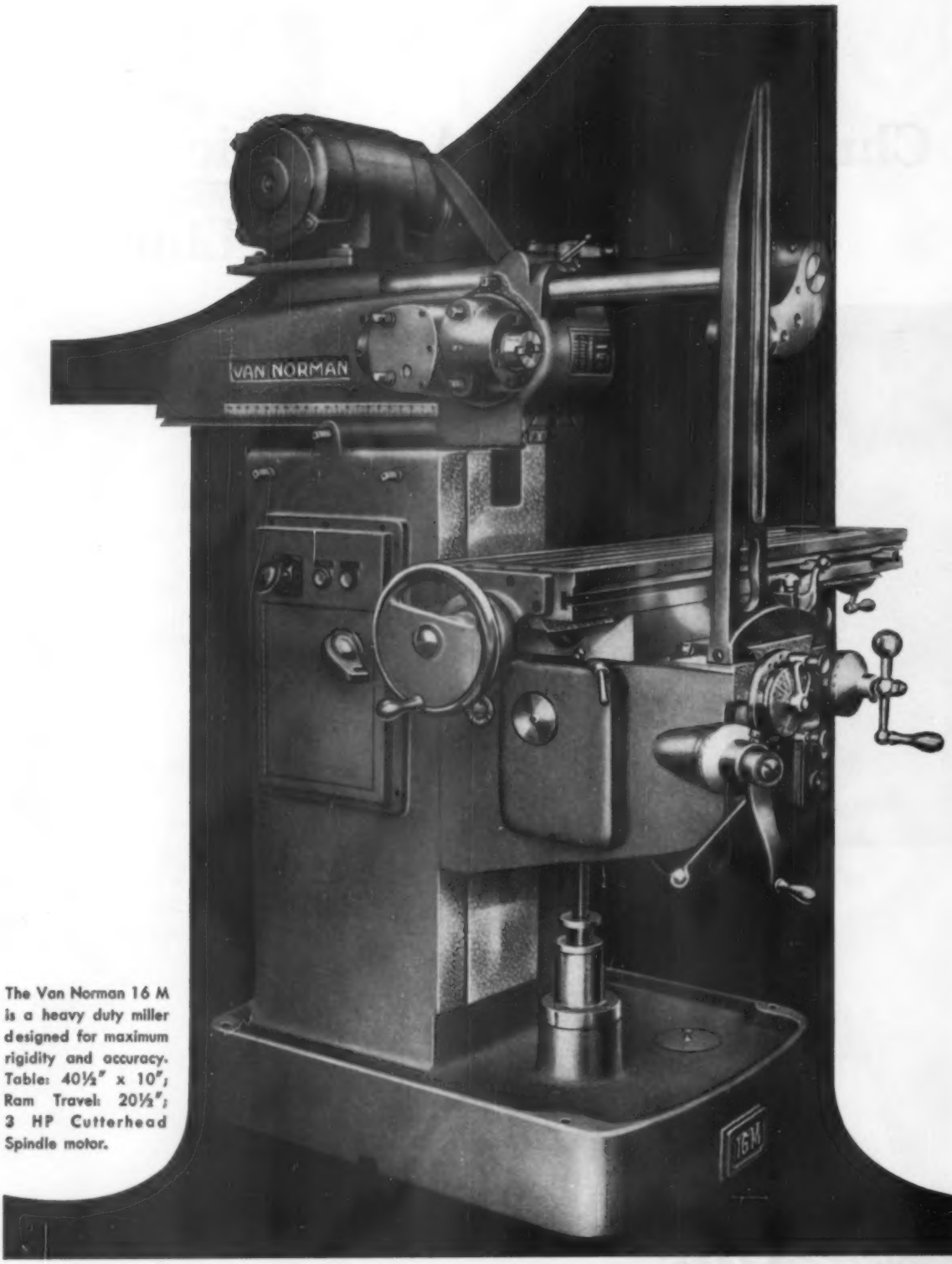
Fellows *Gear Production Equipment*



The Van Norman 16 M is a heavy duty miller designed for maximum rigidity and accuracy. Table: 40½" x 10"; Ram Travel: 20½"; 3 HP Cutterhead Spindle motor.

VAN NORMAN MACHINE

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

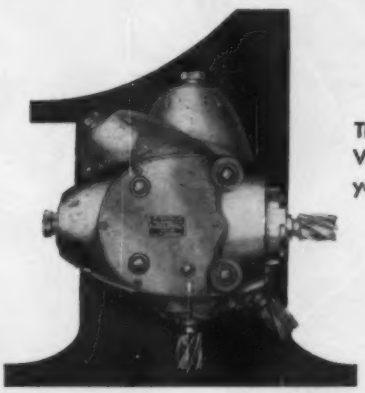
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

ONE VAN NORMAN

Ram-Type Miller

Does the Work of 2 Conventional Millers

Boosts Production . . . Saves Dollars!



This adjustable cutterhead, standard equipment on the Van Norman 16 M, gives you two millers in one. It enables you to do horizontal, angular or vertical milling.

Designed to increase your production and reduce your costs, Van Norman Ram-Type Millers are engineered for maximum cutability, accuracy and rigidity. With a Van Norman Ram-Type Miller, *one* initial investment in *one* machine gives you the equivalent of two conventional millers, also eliminates the need for many costly attachments and special tooling.

Get complete specifications on entire line of Van Norman Ram-Type Millers. Write, wire or telephone for catalog.

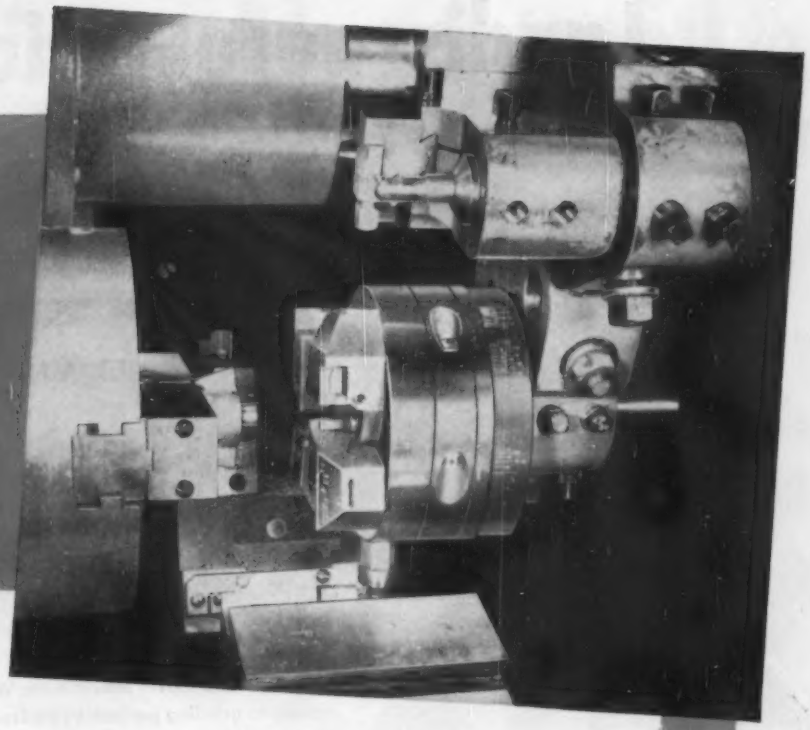
COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

"AUTOMATIC THREADING"
Automatic Chucking
LANDIS
Machine
COMPANY
WAYNESBORO • PENNSYLVANIA
THE WORLD'S
LARGEST MANUFACTURERS OF THREAD

for Machines



The adaptability of Landis Heads is once again proven by this application of a LANDMATIC Head on a #1AC Warner & Swasey Automatic Chucking Machine. Normally, the LANDMATIC is applied to turret lathes and while self-opening, it is closed manually. To adapt this stationary head for automatic operation on the Automatic Chucking Machine, only two steps were required: (1)—the addition of a closing roller in place of the handle and (2)—the use of special closing pins which provide overtravel, eliminating the need of a complicated, accurately-set closing cam.

This adaptability has paid off for the S&C Electric Company, Chicago, Illinois, manufacturers of high voltage protective equipment.

Besides a completely automatic threading operation, this head, through the use of long life tangential chasers, offers lower tool cost and less down time. For example—when threading the workpiece shown, a contact ferrule of 85-5-5-5 cast red brass requiring a 1⅜"—16 Pitch UN thread ⅜" long into a 1/16" relief, complete runs of over 3000 pieces are made without grinding the chasers.

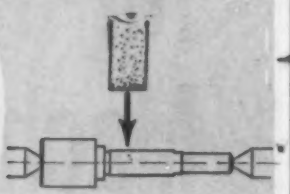
Another outstanding feature of LANDMATIC Heat-Treated Heads is their wide range coverage and oversize capacity. The 2" Head, illustrated here, will normally thread all diameters ranging from ⅜" to 2". Using oversize chaser holders, its range can be increased to thread up to 3¾" in diameter.

For more complete information on LANDIS Heat-Treated Heads for rotary or stationary applications, straight or tapered threading, ask for Bulletin F-90. Please send specifications when writing.

GENERATING

EQUIPMENT

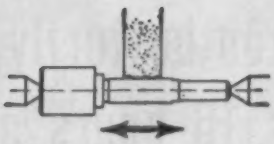
Landis automatic cycle cuts



Operator moves infeed lever. Wheel head moves rapidly to grinding position by hydraulic power. Work rotation and coolant flow begin.

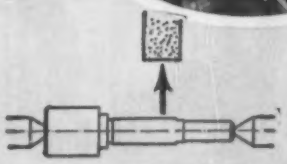
Landis 4" x 18" Type H Plain Cylindrical Grinder with extra cost semi-automatic cycle. Write for catalog A-54.

unit grinding costs up to 50%



Hydraulic slow grinding feed and hydraulic traverse operate automatically. Operator changes dogs on workpieces during grinding period.

Wheel automatically moves back after work has been ground to pre-set size. Coolant stops and infeed lever re-sets.



Operator moves footstock lever to unload and load workpieces. Cycle ready to repeat.

LANDIS
precision grinders

LANDIS TOOL COMPANY
WAYNESBORO, PENNSYLVANIA

Machining for profit with Giddings & Lewis

At Builders Providence Inc., a division of B.I.F. Industries Inc., Providence, R.I.

2 G&L's precision machine cast iron butterfly valve bodies 16 hours a day!

Producing at full tilt, 16 hours a day, these G&L's precision bore, face and mill on a line of tight-closing, rubber-seated, close-grain cast iron butterfly valve bodies ranging in diameter sizes up to 48 inches.

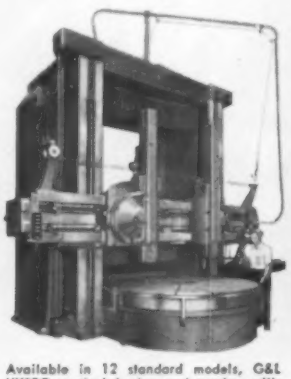
First Machine: 6-ft. HYPRO Vertical boring and turning mill precision bores the valve seat surfaces.

Second Machine: Model 340-T (table-type) horizontal boring, drilling and milling machine with 4" dia., spindle mills the mounting bosses, precision bores the stuffing gland and valve shaft diameters — *in a single setup!*

For complete information and specifications on these machines, contact your nearest Giddings & Lewis representative, or write direct for complete descriptive Bulletins Nos. 30-T (30 Series Horizontals) and 54-12 (HYPRO Vertical boring and turning mills).

Giddings & Lewis 6-ft. Vertical boring and turning mill faces top flange of a 30-inch, tight-closing, rubber-seated, close-grain cast iron butterfly valve body.

Capacity-boosting optional equipment that extends the normal working range of G&L 30-Series Horizontals includes angular milling attachment, continuous feed facing head, automatic electric-operating positioning device for headstock and table, Dupli-Tracer for 2 or 3-dimensional contour tracing and 360° profiling.

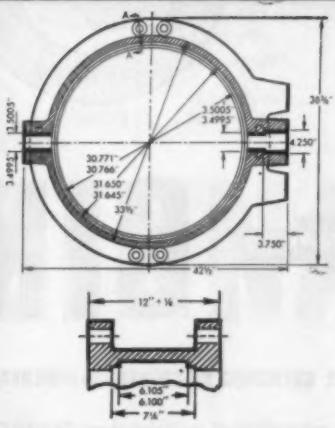


Available in 12 standard models, G&L HYPRO vertical boring and turning mills are offered with table diameters ranging from 54" to 12' and table work load capacities up to 125 tons . . . motor drives up to 100 hp. plus a wide range of optional features and equipment.

Rough and semi-finish and finish boring operations using Davis expandable two-cutter block boring bars are performed on this versatile G&L Model 340-T (table-type) Horizontal. It is equipped with a G&L combination plain, hand and power feed 60" rotary table for fast, accurate indexing of butterfly valve body without changing setup. In addition, Builders Providence Inc., uses the Model 340-T for milling the mounting bosses and stuffing gland face.

G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines and VARIAX Profile Milling Machines.



Section A-A

Butterfly valve body machining sequence

...on Model 340-T Horizontal

- Precision-mill four integral mounting bosses for the valve operator bracket and also stuffing gland face using an 8-inch, 10-tooth, cemented carbide face mill cutter.
- Rough, semi-finish and finish bore 4.250" dia., 3.750" deep stuffing gland bore; rough and finish bore 3.5005" dia. bore within .010" tolerance for valve shaft.

...on 6ft. HYPRO Vertical boring mill

- Rough and finish turn top and bottom flanges... finish to 12", plus or minus .125", from top to bottom flange surface.
- Rough and finish bore inside of flanges to 30.000" within .005" tolerance.
- Rough and finish bore inside diameters 30.771" and 31.650" to 6.105" deep within .005" tolerance.

G-82

How QUALITY are

on Cincinnati Filmatic Plain Hydraulic

FILMATIC Grinding Wheel Spindle Bearings and Automatic Grinding Wheel Balancing are standard equipment. (FILMATIC principle illustrated at the top.) These two exclusive features alone are reason enough to choose CINCINNATI.

Every shop wants closer control of quality and production. It's especially desirable for final operations, when cost per unit nears its maximum. In the field of precision centertype grinding on 6" to 14" machines, CINCINNATI'S® standard features and extra equipment combine quality control and production control into a unified, automatic function of the machine. You will be interested in knowing how:

No adjustment of grinding wheel spindle bearings required for any job setup. FILMATIC bearings are self-adjusting.

Grinding wheel is automatically balanced in a few seconds, on the machine, at operating speed.

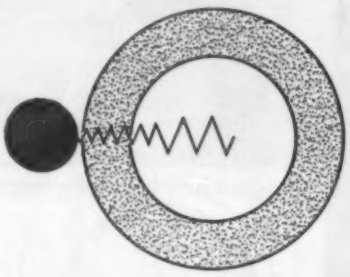
*Automatic Air-Electric Gage Sizing incorporates cycle time stabilizer. As the wheel wears, original length of cycle and the time required to complete the cycle are automatically maintained.

The non-productive time spent in "cutting air," occasioned by variations in grinding stock, is greatly reduced by the *Gap Eliminator feature. The actual grinding rate starts only when the wheel contacts the work.

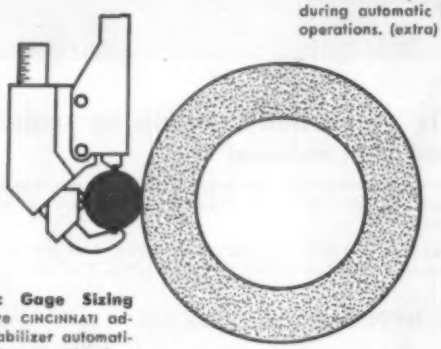
The above cost-control features and many others are outlined in two attractive catalogs, indicated in the table on the right-hand page. Write for copies, or look in Sweet's Machine Tool File for brief specifications.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

★Extra Cost



★ **Gap eliminator** . . . greatly reduces time spent in "cutting air" during automatic infeed grinding operations. (extra)



★ **Automatic Air-Electric Gage Sizing** (extra) includes an exclusive CINCINNATI advantage . . . cycle time stabilizer automatically compensates for wheel wear and truing.

CINCINNATI

CIN

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Section A-A

and PRODUCTION automatically controlled

Grinding Machines

Members of this family group of CINCINNATI FILMATIC Plain Hydraulic Grinders are:

Size	Between-Center Lengths	Catalog
6"R } 10"L }	18" and 30"	G-660—2
10"R } 14"L }	18", 36", 48" 72" and 96"	G-661—1

CINCINNATI FILMATIC
6"R x 18"
Plain Hydraulic Grinding Machine
Equipped with Automatic Infeed, Automatic Air-Electric Gage Sizing, and Gap Eliminator.

CINNATI

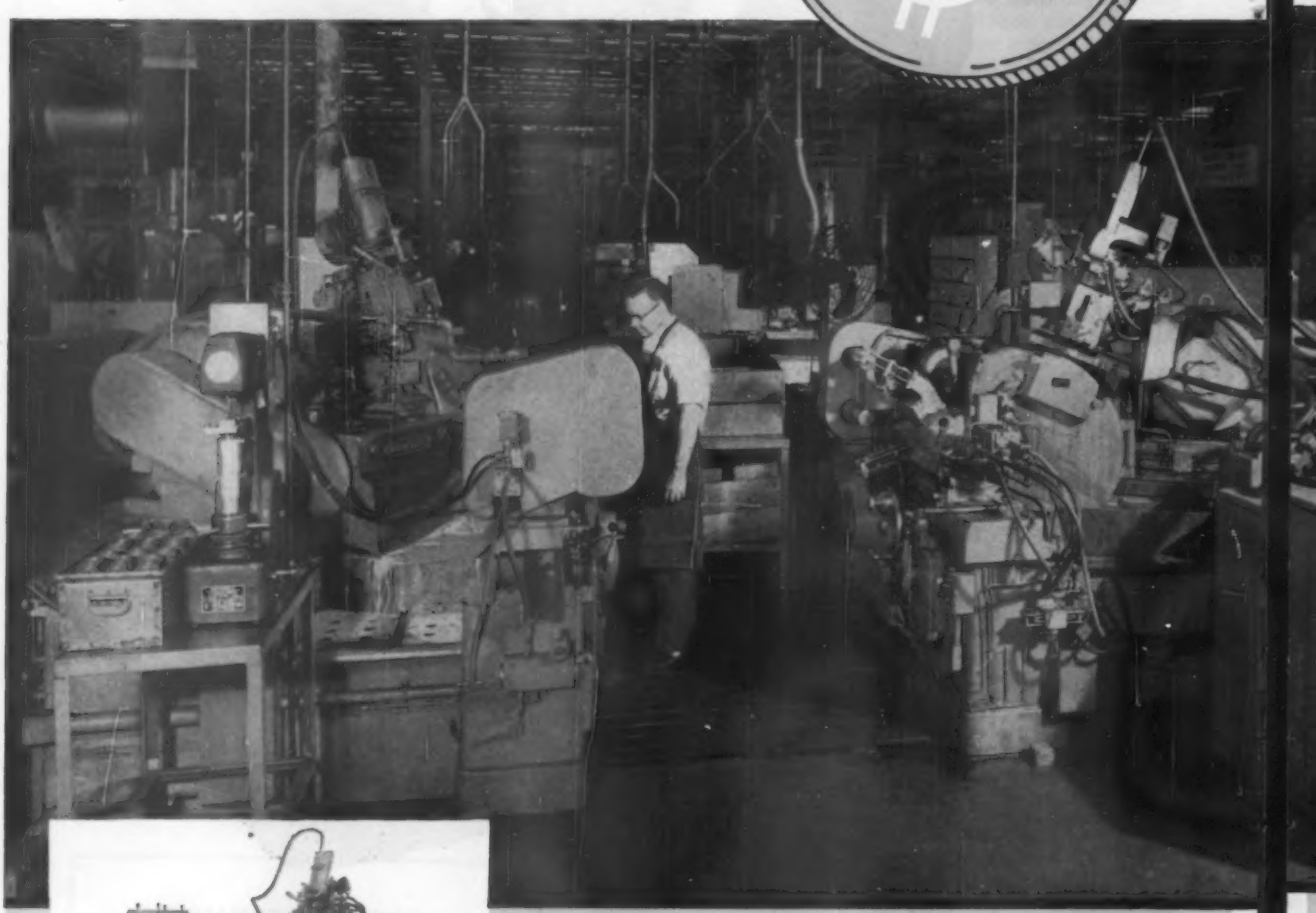
FILMATIC

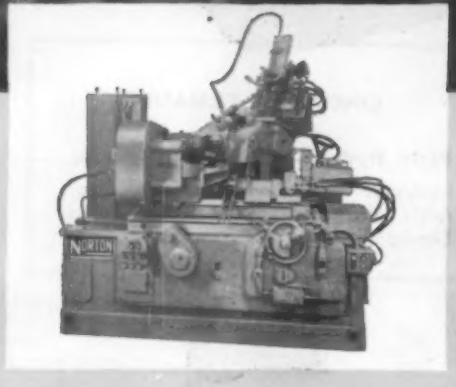
GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

First grinder to do this job — this way!

Versatile Norton Type CV-4 Machines in big transmission plant

enable new cost-cutting operation





TWO NORTON TYPE CV-4 10" Automatic Angular Wheelslide Grinders that have made possible a new, improved grinding method in the transmission plant of a prominent automotive manufacturer. (See other photo and diagram for details.) These two machines are tended by a single operator, who merely keeps the automatic loading device supplied with parts and removes ground parts from the unloading chute. Designed to grind thrust surfaces and adjacent diameters in one automatic plunge grind, Type CV-4's eliminate the usual separate operation on the shoulder or thrust surface. They are available with hand table or hydraulic power table traverse in 10" and 14" sizes, and in work lengths of 18", 30", 48" or 72".

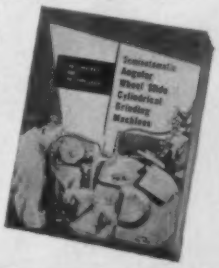
The job described here proves how easily the Norton Type CV-4 Automatic Angular Wheelslide Grinder can be adapted to meet individual needs for more efficient grinding operations.

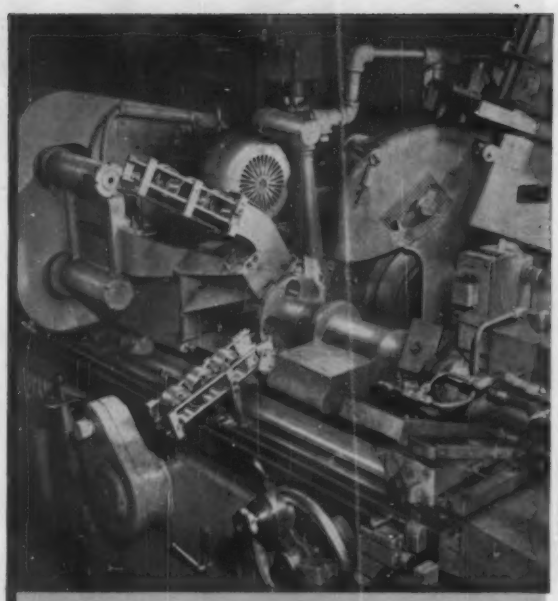
Doing several fast, precision grinding jobs at once is routine performance for this advanced cylindrical grinder. And it does them better! For example, it leaves a concentric grain pattern in the thrust surface finish, improving the seal surface and appearance. Other "Touch of Gold" advantages for rapid grinding action and top-quality production, with simplified operation and maintenance include:

- *Automatic wheel feed with "click-count" index enables settings for wheel slide movement in increments as fine as .00005". Graduated wheel feed hand wheel indicates amount of feed as it rotates. Both length and rate of automatic wheel feed easily adjusted from operation position.*
- *Automatic wheel head mounted truing device (optional) provides push-button control of straight, stepped or formed truing — eliminates need of skill and reduces wheel cost per piece ground.*
- *Ramped outlet from coolant tank speeds clean-out . . . pumps and motors all outside and easy to reach . . . electrical controls all grouped in raised enclosure . . . base ways protected by steel tape guards, requiring no additional floor space . . . hydraulic oil and ways lubricant carried in outside reservoirs with large gauge-glasses.*

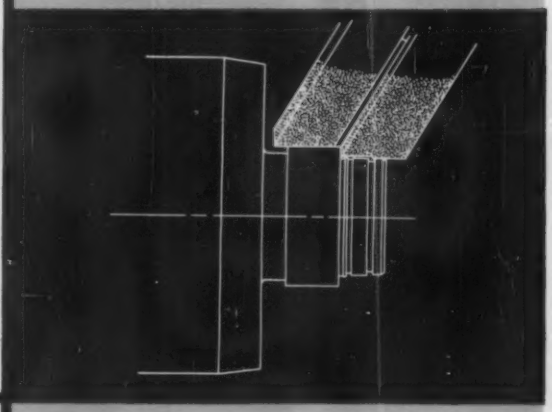
Type CV-4's in YOUR Production

can do the work of two or more ordinary cylindrical grinders. Why not get more facts on how replacing obsolete grinding equipment with these modern machines can improve your competitive position and increase your grinding profits? Ask your Norton Representative for Catalog No. 1658-1, or write us direct. And remember, only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.





NEVER DONE BEFORE! A close-up of one of the Type CV-4 Grinders in the larger photo. Workpieces are being fed into the chuck from a Norton automatic turret-type loading device. An automatic angular plunge grind, followed by automatic traverse off the piece grinds the diameters *and leaves a sharp corner at top of the shoulder* — a new time-saving way to do this job. Stock removal is .025" on diameters and .005" on face. Inset diagram shows surfaces ground and sharp corner left on shoulder.



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NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

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BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes

HARDINGE
ELMIRA, N.Y.

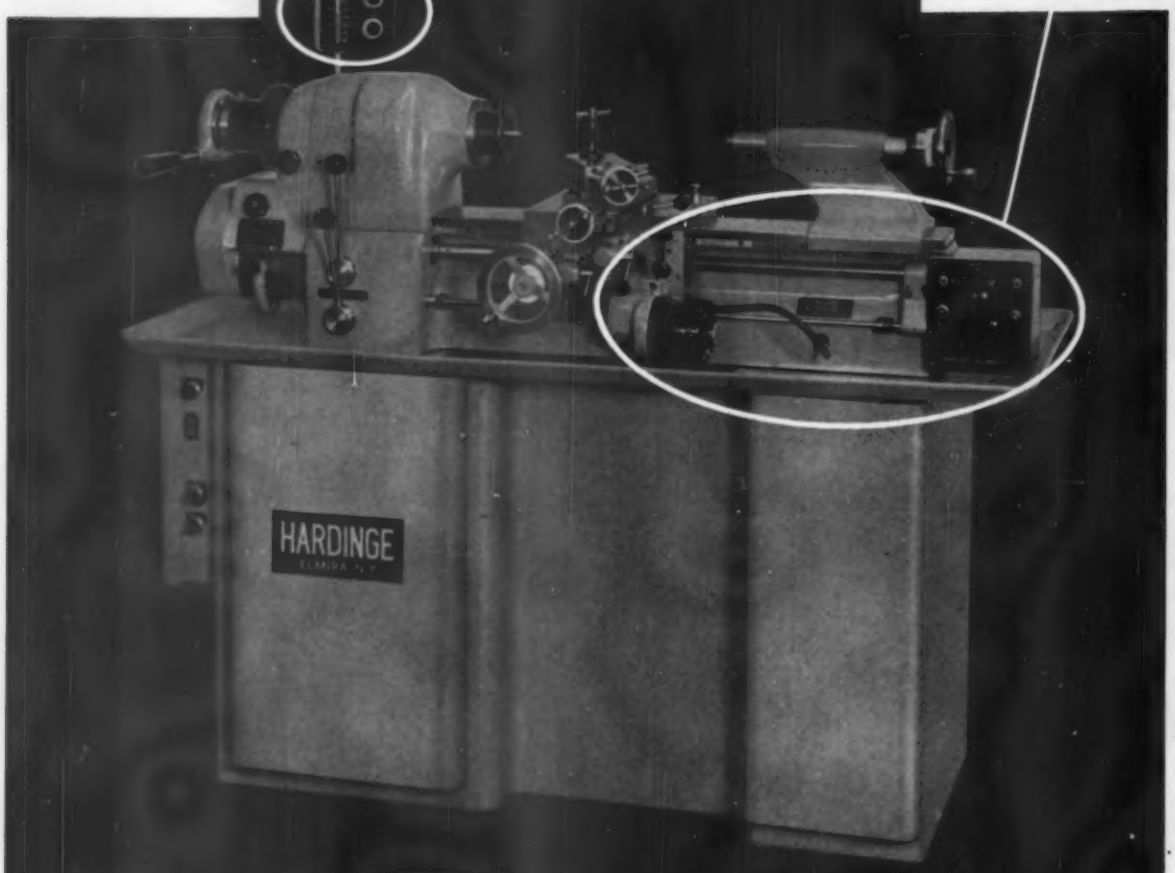
Tool Room and Production Lathe

Features

Infinite Control of Speed and Feed

Variable Speed Drive for Headstock Spindle

Variable Feed Drive for Carriage and Cross Slide



RIGIDLY BUILT TO TAKE ADVANTAGE OF CARBIDE CUTTING TOOLS AT HIGH SPEEDS.

Both drives are independent and infinitely variable to secure every possible combination of speeds and feeds.

Write HARDINGE *for Bulletin HLV*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

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Landis 12" x 28" Universal and Tool Grinder, a compact, versatile grinder ideal for toolroom, maintenance or small shop.

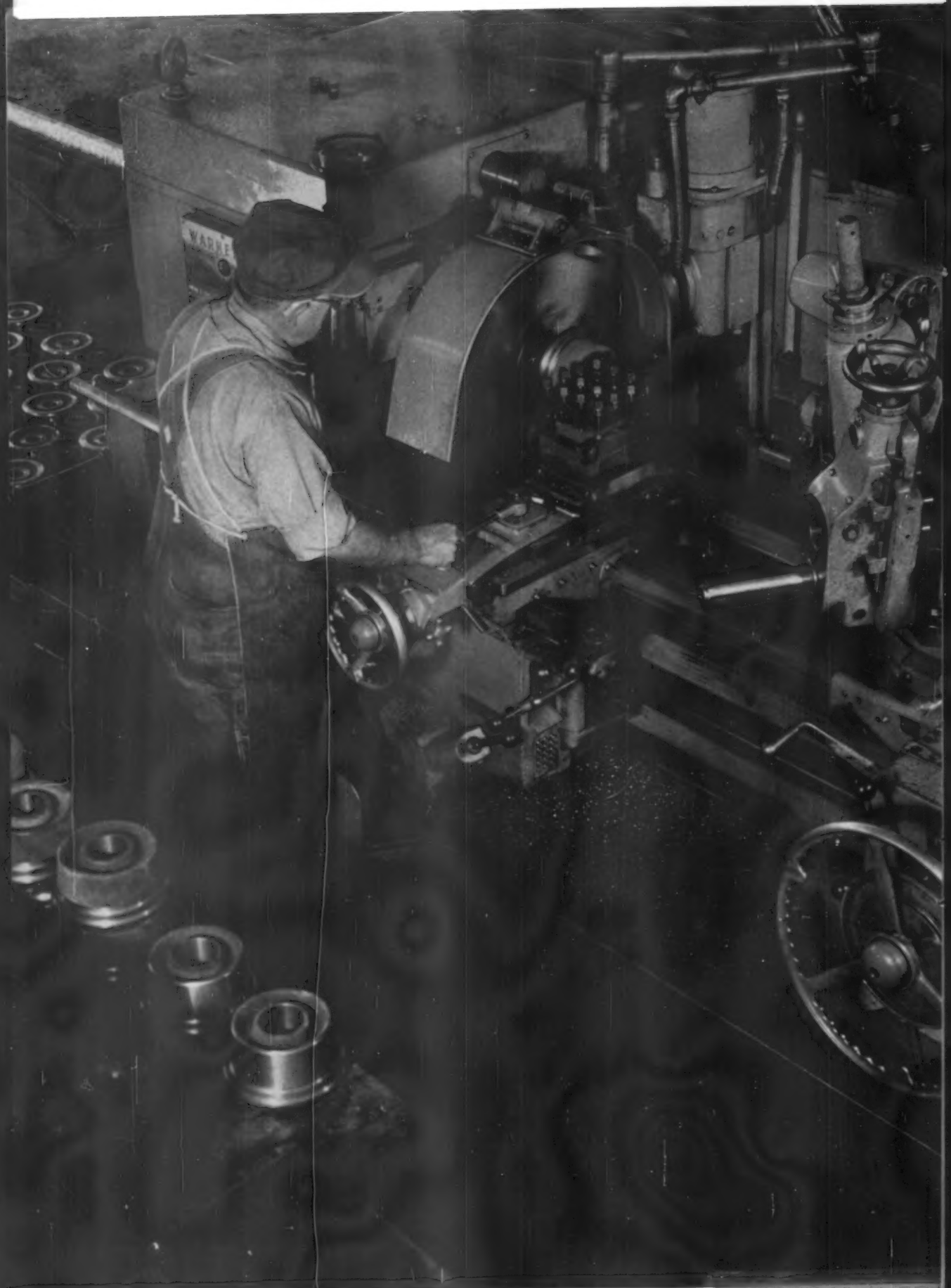
Grinding operations with *standard* equipment

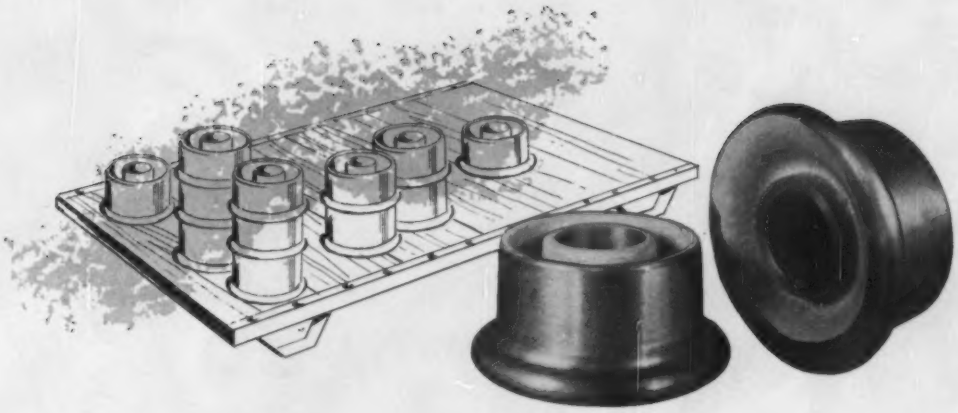
cylindrical
taper
flat surface
face
and many tool sharpening operations

22 optional accessories extend range of grinding operations

One compact machine performs 28 different grinding jobs

LANDIS
precision grinders
LANDIS TOOL COMPANY / WAYNESBORO, PENNA.





How Dempster Brothers solved the small-lot problem!

Dempster Brothers, Inc. of Knoxville, Tennessee—well-known makers of Dempster-Dumpster refuse-handling equipment—had a serious small-lot problem. Turning costs on their obsolete equipment were getting completely out of hand. Modernization was a must! But in order to profitably handle their wide variety of jobs ranging in lots from 5 to 200 pieces, they had to select the most versatile equipment possible.

Dempster found their answer in a new Warner & Swasey 3-A Saddle Type Turret Lathe, equipped with a 50 horsepower motor, cross slide taper and thread-chasing attachments and power chuck wrench. On the first job—a 200-piece lot of cast iron rollers (shown above)—production increased 3 to 1 over their old equipment.

Dempster particularly liked their 3-A's:

- **FLEXIBILITY AND EASE OF SETUP** which minimized inventory problems for both production and repair parts.
- **QUICK, SIMPLIFIED SPEED CHANGING** of the all-hydraulic headstock, giving optimum speeds for every cut.
- **RIGIDITY AND HIGHER SPEEDS** which permitted heavier roughing cuts and enabled close tolerances (plus or minus .001") to be held with fewer cuts.
- **POWER CHUCK WRENCH CONTROL** that substantially reduced part handling.
- **EASE OF OPERATION** that lessened operator fatigue and cut machine handling time.

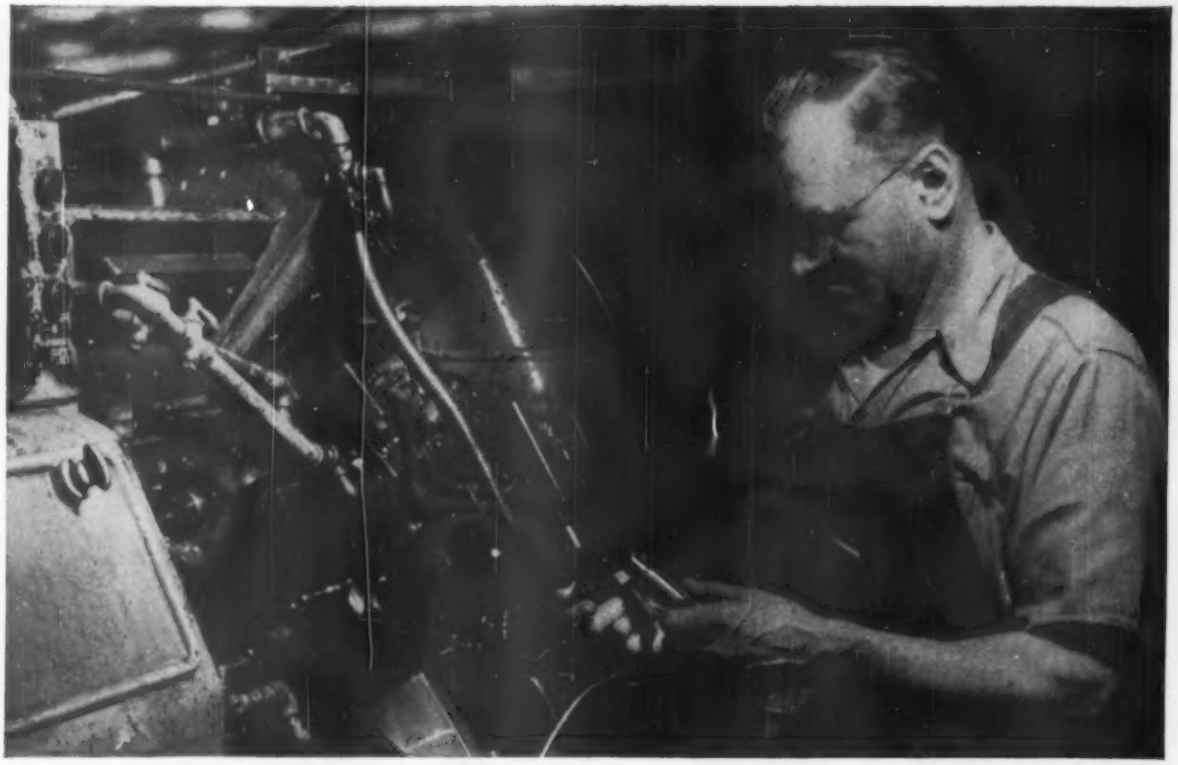
Call in your nearest Warner & Swasey Field Representative and let him show how these versatile machines, properly tooled, can handle your jobs more efficiently—boosting both production and overall profits.

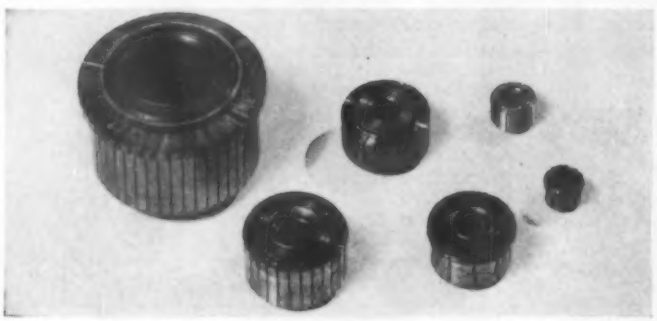
YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS

...WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

IF YOU MACHINE STAINLESS STEEL





REPUBLIC COLD DRAWN LEADED ALLOY STEELS have helped Han-Kor Inc. of Cleveland, Ohio realize significant tool savings in mass producing electric motor commutators such as those shown above. Because each commutator is simply pressed onto its motor shaft, the center hole in the steel hub must be virtually perfect. Pull broaches used for this operation lasted for only 25,000 pieces when ordinary steel was used. Several years ago Han-kor switched to leaded steel and, since that time, no broaches have required replacement. Republic Cold Drawn Leaded Alloy and Carbon Steels may provide savings in time and money in your operations. Send coupon for more information.

REPUBLIC WEDGE-LOCK STEEL SHELVING is the world's strongest. And it actually gains strength as weight increases. Wedge-Lock is specifically designed for high stacking of such heavy items as dies and tools. It provides maximum loading in minimum floor space. There's no sagging, swaying or buckling. It can be assembled quickly and easily and is completely flexible to meet changing requirements. A shelving expert will help you plan your shelving arrangement .

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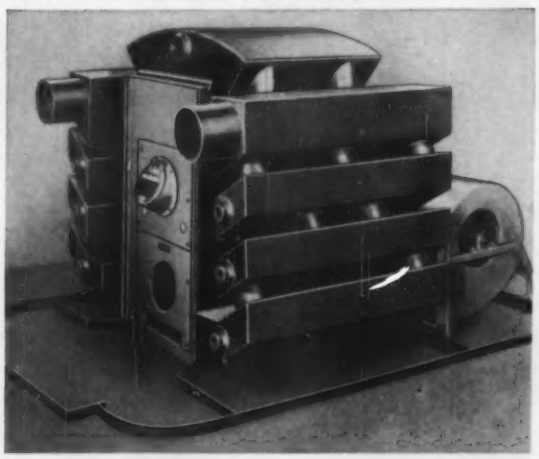
Do you know what causes tools to heat and burn, chatter marks, tapped holes to vary in size, rough threads, tooth breakage, burnished surfaces? Or what feed and speed to use when twist drilling .250 holes in A.I.S.I. 430-F?

The answers to these and many other questions are contained in Republic's *free book,* "How To Machine ENDURO Stainless Steel Bars".

This 96-page, pocket-sized manual is planned to help you obtain the best possible results when machining ENDURO bars. One section contains precise, accurate information on the basic principles of machining and how to correct troubles. Another section explains types and properties of stainless. Forty-two pages are devoted to estimating-tables covering conversion of fractional inches to decimals and millimeters, stock required for 1000 pieces, r.p.m. of spindles at given surface speeds, etc.

If you machine stainless steel parts you'll like this book. You will also like Free-Machining ENDURO® Bars. Here is a metal unsurpassed in high physical and chemical properties to which has been added the advantages of cold drawing: accuracy of section, close tolerance, uniform soundness and a fine surface finish. Two grades, A.I.S.I. Types 416 and 430-F are fully 90% as machinable as Bessemer screw stock. Republic also supplies ENDURO in hot rolled bars, special sections and wire.

Our metallurgists and machining specialists will give you expert, obligation-free assistance on application, processing and use. Just send the coupon if you would like one to call, or for your copy of, "How To Machine ENDURO Stainless Steel Bars".



REPUBLIC ELECTRUNITE® MECHANICAL TUBING provides safe, gas-tight joints required by the down-flow construction of this year-round furnace and air-conditioning unit. Uniform diameter, wall thickness, concentricity, strength, and ductility of ELECTRUNITE simplify design and help speed output of superior parts. Quality control from ore to finished tubing assures long, trouble-free service. Available in carbon and stainless steels.

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Well...we have one!

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covers our engineering features that **eliminate operator fatigue**

No reaching, no bending, no straining — the operator stands comfortably in front of the broaching fixture he is loading. Everything is right at hand, convenient, easy . . . *and safe!*

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Ease of operation yields greater production, because the operator can easily keep up to the capacity of the machine. And here's an interesting fact: some plants give senior employes the preference to operate our broaching machines equipped with TIP-DOWN Fixtures. (Proof of their desirability!)

Are you hoping to cut your production costs in the near future? Very probably you can save real money on several of your present operations *by converting to Lapointe-Broaching.* Why not invite a qualified Lapointe Field Engineer to drop in on you to discuss broaching, and explain these remarkable TIP-DOWN Fixtures?

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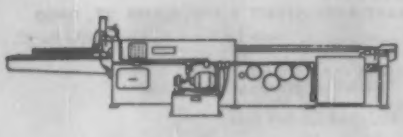
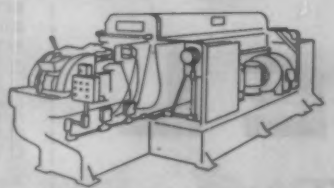
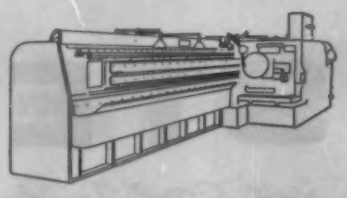


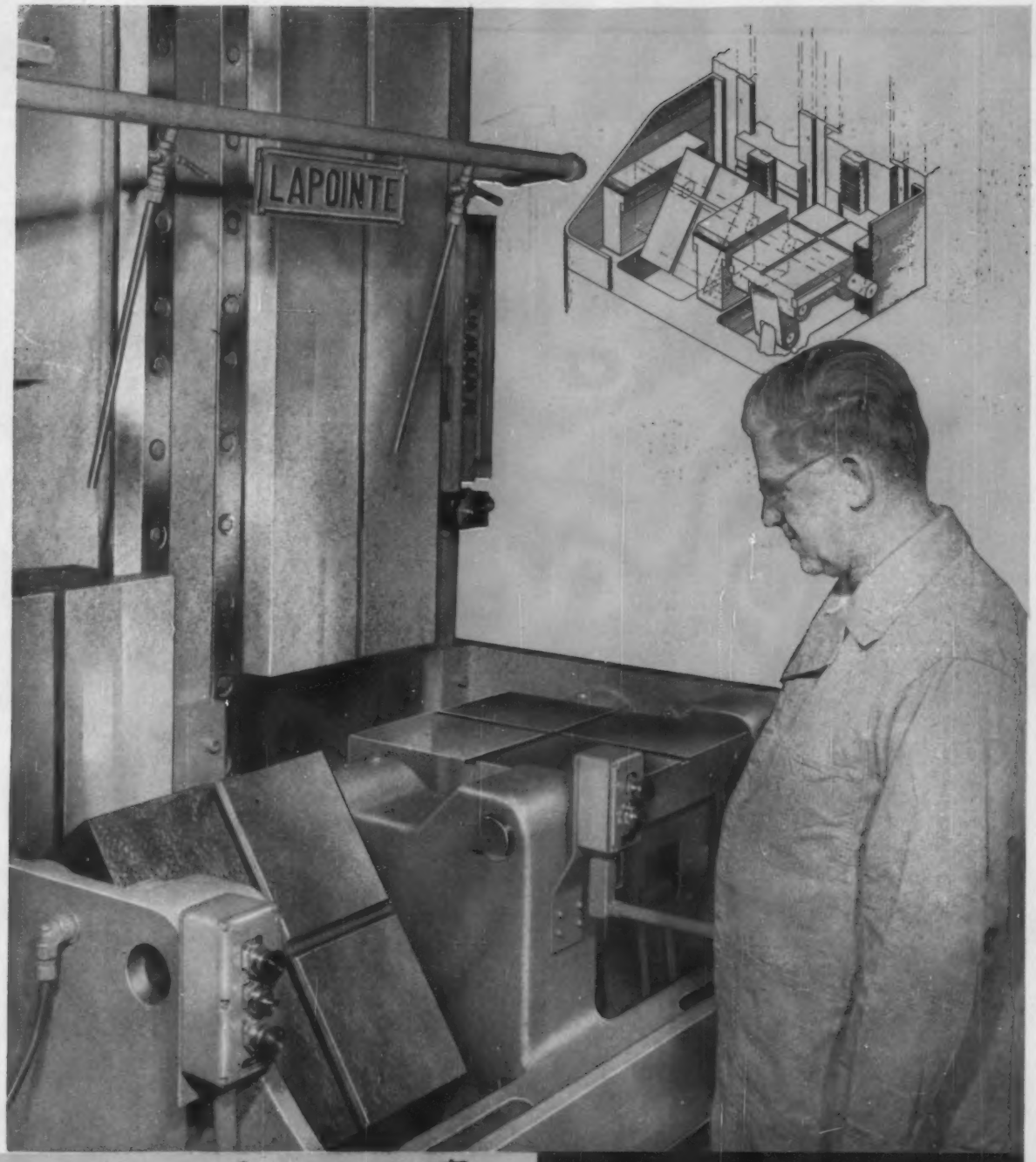
60" STROKE HORIZONTAL, ELECTRIC

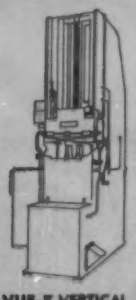


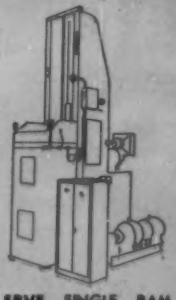
CH CONTINUOUS BROACHING, ELECTRIC

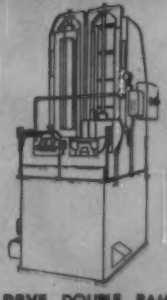


SRHE SINGLE RAM HORIZONTAL, ELECTRIC




VUE-7 VERTICAL PULL-UP ELECTRIC


SRVE SINGLE RAM VERTICAL, ELECTRIC


DRVE DOUBLE RAM VERTICAL, ELECTRIC

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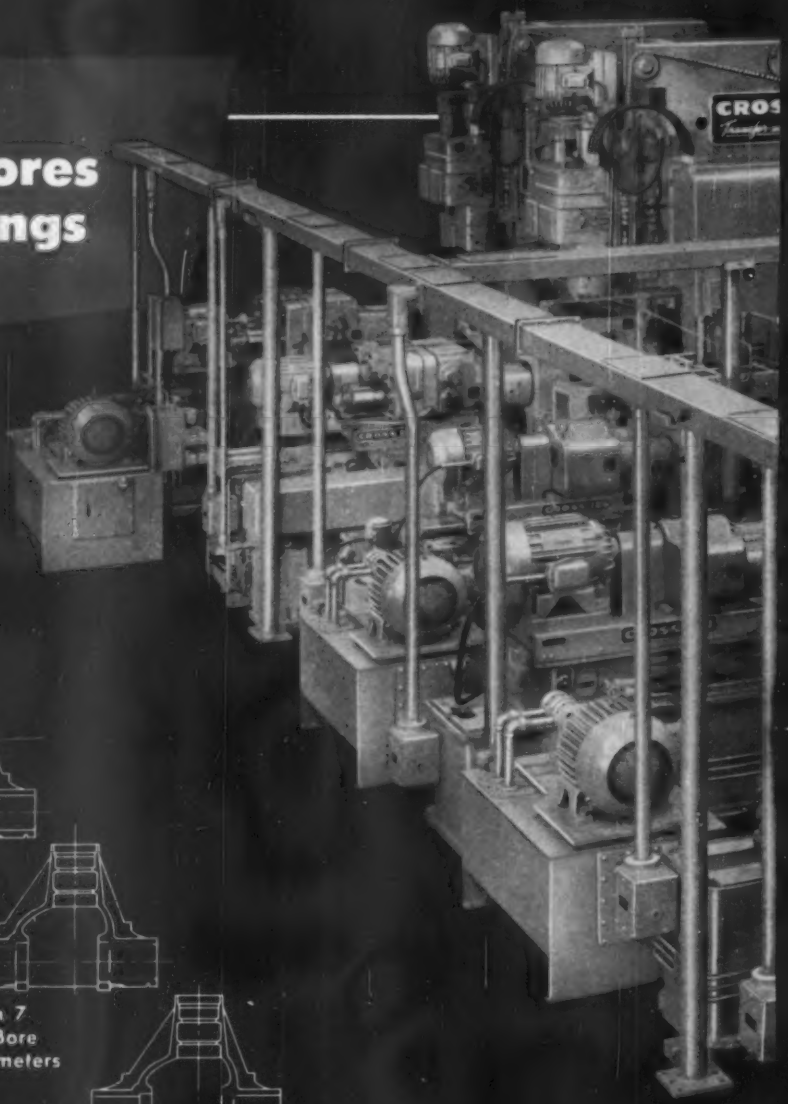
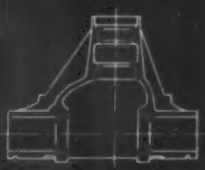
Precision Bores Axle Housings

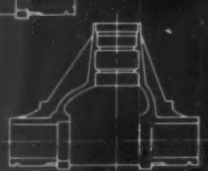




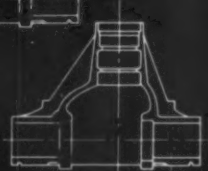
Station 11
Finish Bore
Four Bearing Seats

Station 9
Semi-Finish Bore Oil Seal
and Bearing Seats

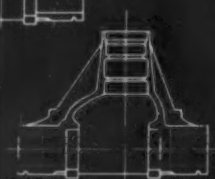
Station 7
Finish Bore
Tube Diameters



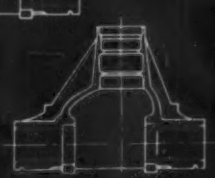
Station 5
Rough Back-bore
Right Side



Station 4
Rough Back-bore
Left Side



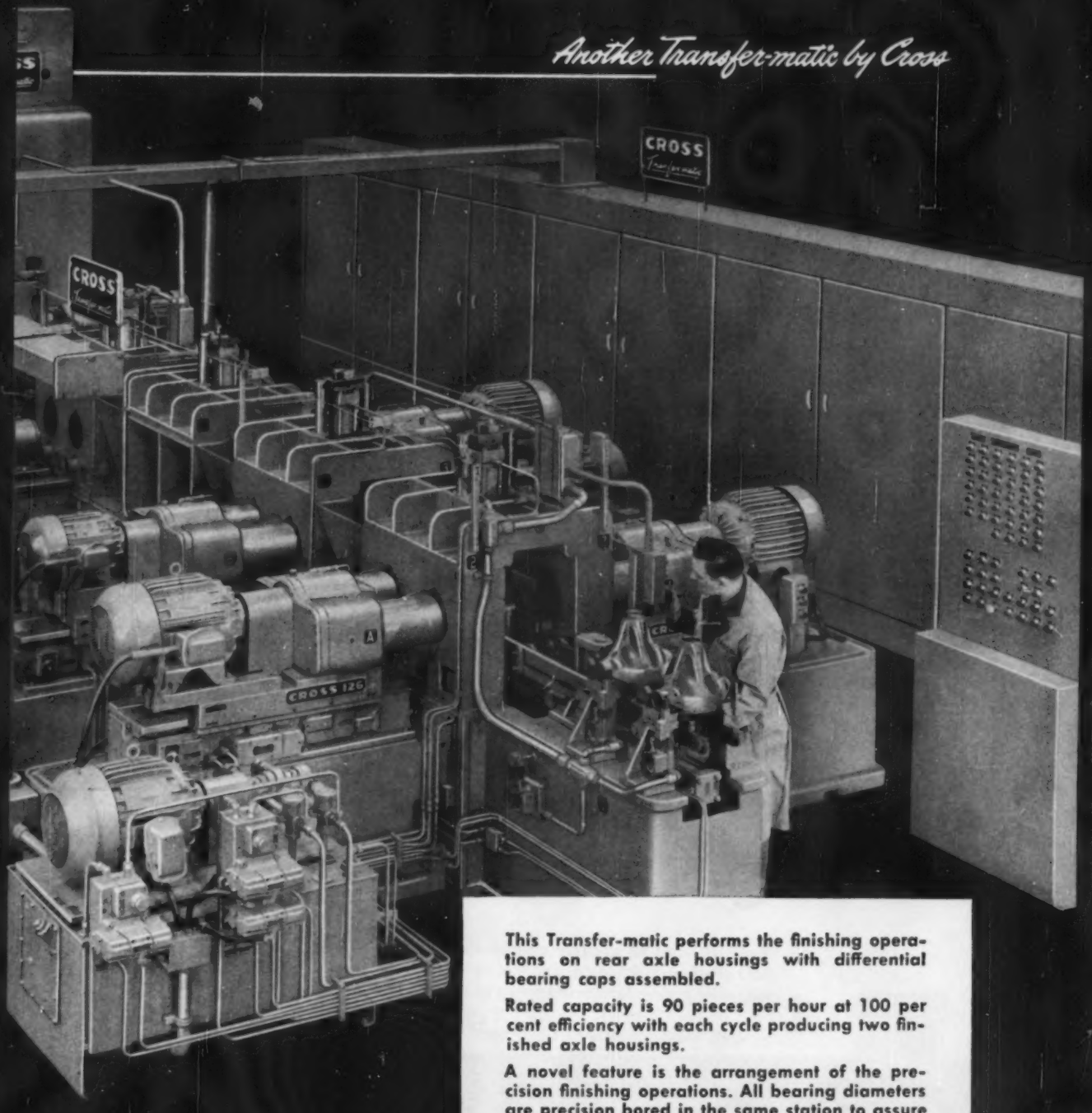
Station 3
Semi-Finish Bore
Tube Diameters



Station 2
Rough Bore
Tube Diameters

Station 1
Load Two Parts

Another Transfer-matic by Cross



This Transfer-matic performs the finishing operations on rear axle housings with differential bearing caps assembled.

Rated capacity is 90 pieces per hour at 100 per cent efficiency with each cycle producing two finished axle housings.

A novel feature is the arrangement of the precision finishing operations. All bearing diameters are precision bored in the same station to assure precise gear centers. The vertical boring unit finishes first one and then the other of the two pinion shaft bearing diameters. In the same station, opposed horizontal units back-bore the differential bearing diameters. Perfect concentricity and squareness of the shoulders are obtained between the two pinion bearing seats since both are bored with the same spindle.

Other features are complete interchangeability of all standard and special parts for easy maintenance, construction to JIC standards, hardened and ground ways, hydraulic feed and rapid traverse and automatic lubrication.

Established 1898

THE CROSS CO.

First in Automation

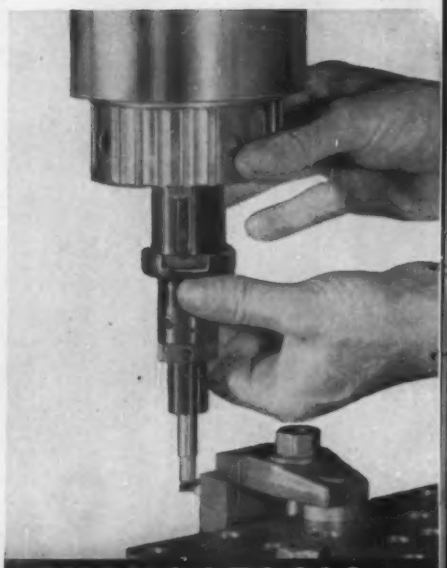
PARK GROVE STATION • DETROIT 5, MICHIGAN

MEASURE

Dial dimension direct from print. There are two sets of direct-reading drum dials, one for longitudinal, the other for transverse position. Operator simply sets dials so that numbers on dials correspond with numbers on blueprint. Simple. Direct. Precise.

POSITION

Press two buttons, one for longitudinal, one for transverse positioning. Table, and work, are automatically positioned, and clamped under the tool, accurate to ± .0001"! Accuracy is dependent upon highest-quality gages, not upon screw threads. Sensitive .0001 Dial Indicators maintain a positive check at all times.



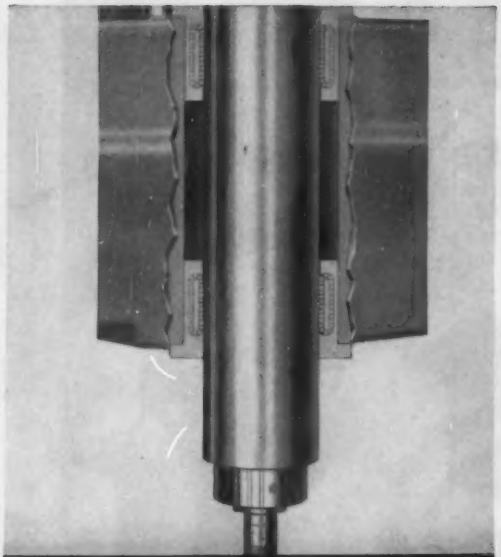
CHANGE TOOLS

Tool changing takes less than 10 seconds, with BF spindle. Can be accomplished while table is positioning. Hole sizes are repeated within ± .0001", without resetting tools! High-precision tool holder is built right into the spindle of the Jig Borer. Adapters accommodate both standard and special-sized tools.

FOSMATIC JIG BORER

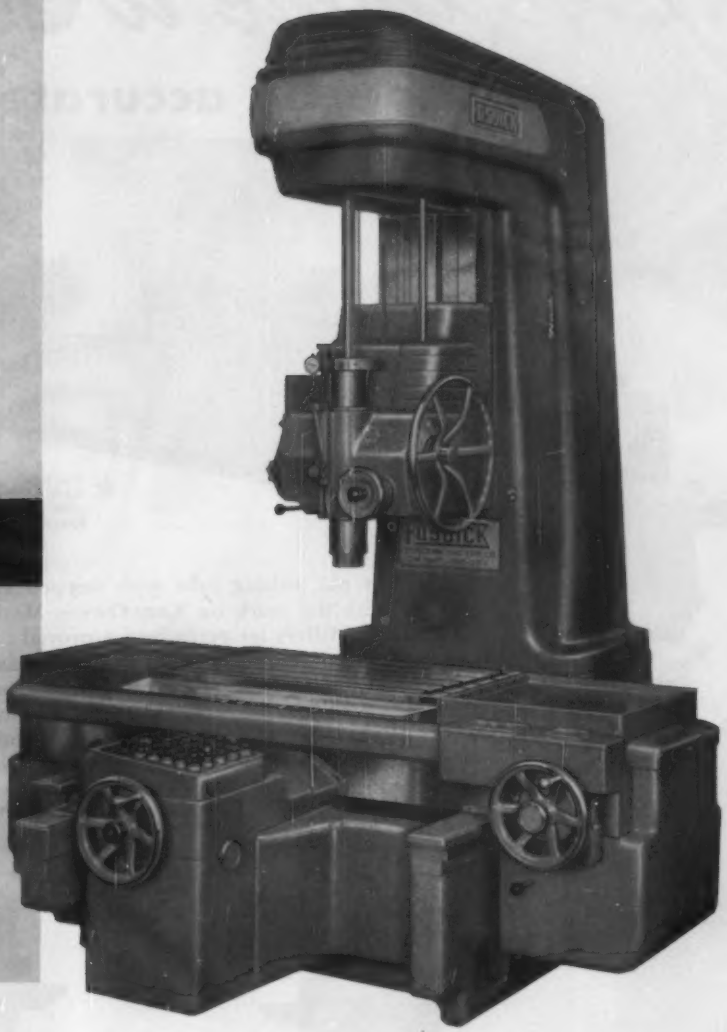
AUTOMATIC POSITIONING

DIRECT DIMENSION MEASURING



BORE

Push-button precision boring. For finish boring, change tools quickly, then bore at touch of button. The hardened alloy steel quill rides on 800 preloaded balls mounted in precision bushings located permanently at top and bottom of head—as close as possible to spindle nose for maximum rigidity. Spindle is guaranteed not to exceed .0002″ runout at the end of 12″ proving bar!



MEASURE - POSITION - CHANGE TOOLS START BORING . . . ALL IN SECONDS!

hole size and position accurate to ± .0001.

The new Fosdick Jig Borer can be used for the finest toolroom boring or for production of precision holes. Like the scores of Fosdick Jig Borers in plants throughout the United States, this machine will perform consistently to ± .0001″ . . . in measured table and saddle position as well as hole size.

The Fosmatic Jig Borer is extremely simple to operate. Changing of feeds and speeds, all movements of the table, saddle, and head can be accomplished by push button. Spindle is started and stopped by lever on head. Machine may be equipped with or without automatic positioning. Can be equipped for numerical control with either tape or card systems.

Other features available as extra equipment include Milling Feed, Rapid Traverse to Quill, coolant system and reversing motor for tapping.

Ask for Fosmatic Jig Borer Bulletin, JB-A.

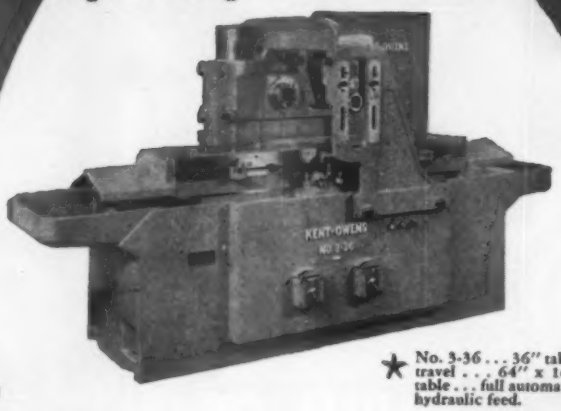
NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!

FOSDICK

THE FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO

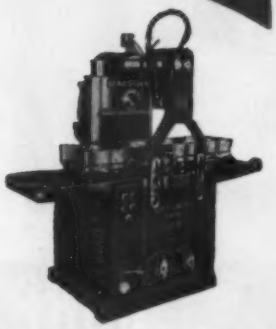
Every one a Star

for speedy accurate milling!



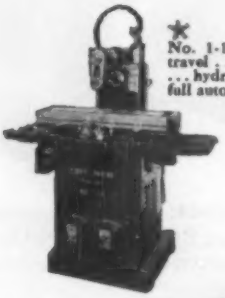
★ No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.

★ No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.

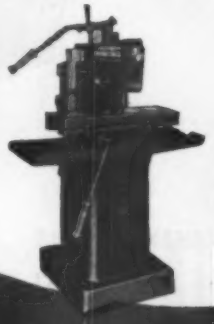


★ No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

You'll turn out milling jobs with stepped up speed and accuracy with the work on Kent-Owens Machines! These extra-rugged Millers are performance-proved . . . simple . . . versatile . . . practical in every detail. Advanced features throughout! Twin-post head mounting assures balanced load. Only two gear contacts, motor to spindle, means greater cutting efficiency. Check your needs! Write today for bulletins on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, Ohio.



★ No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



★ No. 1-M . . . Hand feed to table and head . . . 25" x 9" table travel . . . head counter-balance is adjustable.

CALL ON

KENT-OWENS

for milling machines

KENT-OWENS REPRESENTATIVES

MEMORANDUM
FROM ENGINEERING DEPARTMENT
12/12/56
Design Group
Att.: C. D. Smith
Vibrating Conveyor #3 broke down after approximately
17,000,000 cycles of operation. Spring return lever
failed, due to low fatigue resistance. Flexloc locknuts
worn, but still locked in original positions.
Recommendations:
1) Redesign lever to give increased strength in
center section.
2) Eliminate side play in lever motion which has
been causing excessive wear in related parts.
3) Continue use of Flexloc locknuts.
B.F.W.

Why designers specify FLEXLOC self-locking nuts

Where products must be tough . . . must stand up under vibration, shock and abuse . . . designers specify rugged, reliable, precision-built FLEXLOC self-locking nuts as fasteners.

HERE'S WHY:

FLEXLOC locknuts are strong: tensile strengths far exceed accepted standards. They are uniform: carefully manufactured to assure accurate, lasting spring tension in the flexible locking collars. And they are reusable: rough screw threads, repeated removal and replacement, frequent adjustments will not affect their locking life.

Standard FLEXLOC self-locking locknuts are available in a wide range of standard sizes and materials, to meet the most critical locknut requirements. Your authorized industrial distributor stocks them. Write us for complete catalog and technical data. Flexloc Locknut Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

We also manufacture precision titanium fasteners. Write for free booklet.

FLEXLOC® LOCKNUT DIVISION

STANDARD PRESSED STEEL CO.

SPS

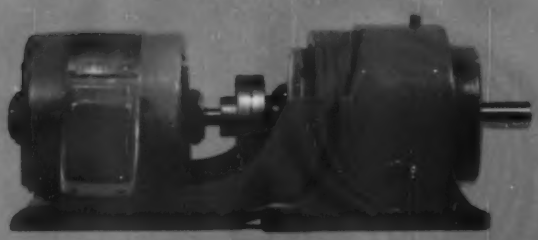
JENKINTOWN PENNSYLVANIA

A great gear-motor

NEW integral unit

Compact, one-piece unit has complete, easily removable motor, machined-in alignment.

NEW all-motor unit



Providing wide application flexibility, motor change may be accomplished without disturbing gear.

General Electric's NEW gear-motor line

Now, you can meet all your low-speed drive requirements from a brand new line of General Electric packaged power transmissions. This 3-unit line is based on a new, completely simplified, helical design that has evolved from General Electric's 25 years of gear-motor engineering and application experience. And it's a line that can provide you with important, 3-way savings on all low-speed applications.

1. Greater reliability: This new line incorporates the most advanced gear manufacturing methods and all units are factory tested before shipment. In addition, you benefit because you purchase both motors and gears from a single manufacturer.

2. Easier Maintenance: A cinch to assemble and disassemble, alignment is machined right into each unit. Gear components may be carried in stock as sub-assemblies, minimizing downtime for normal repair.

3. Reduced inventory: You can reduce your inventory with no sacrifice to your operating continuity. Parts standardization and interchangeability permit a basically lower inventory investment.

This new line was developed to keep pace with the new requirements and wider applications of gear-motors brought about by advanced manufacturing techniques. *Get complete information from your nearest Apparatus Sales Office or Distributor—or write for bulletin GEA-6704, containing line highlights, to General Electric Co., section 851-6, Schenectady, N. Y.* Gear-Motor and Transmission Components Dept.

NEW separate reducer

Unit can provide a variety of output speeds with change of belt or chain rates.

Progress Is Our Most Important Product

GENERAL ELECTRIC

VERSATILITY UNLIMITED!

"BUFFALO" No. 1 "RPMster"

"1001" Speeds, Easily and Instantly Changed by Moving Just Two Controls!

Check with the man who uses one. He'll tell you why the "Buffalo" "RPMster" is the drill he *likes* to operate . . . how it ups his output . . . improves the quality of his work.

Because you have to operate this machine yourself — under actual shop conditions — before you'll really understand why it's the favorite of shopmen and supervisors alike. Only when you *do* operate it will you discover its many exclusive advantages.

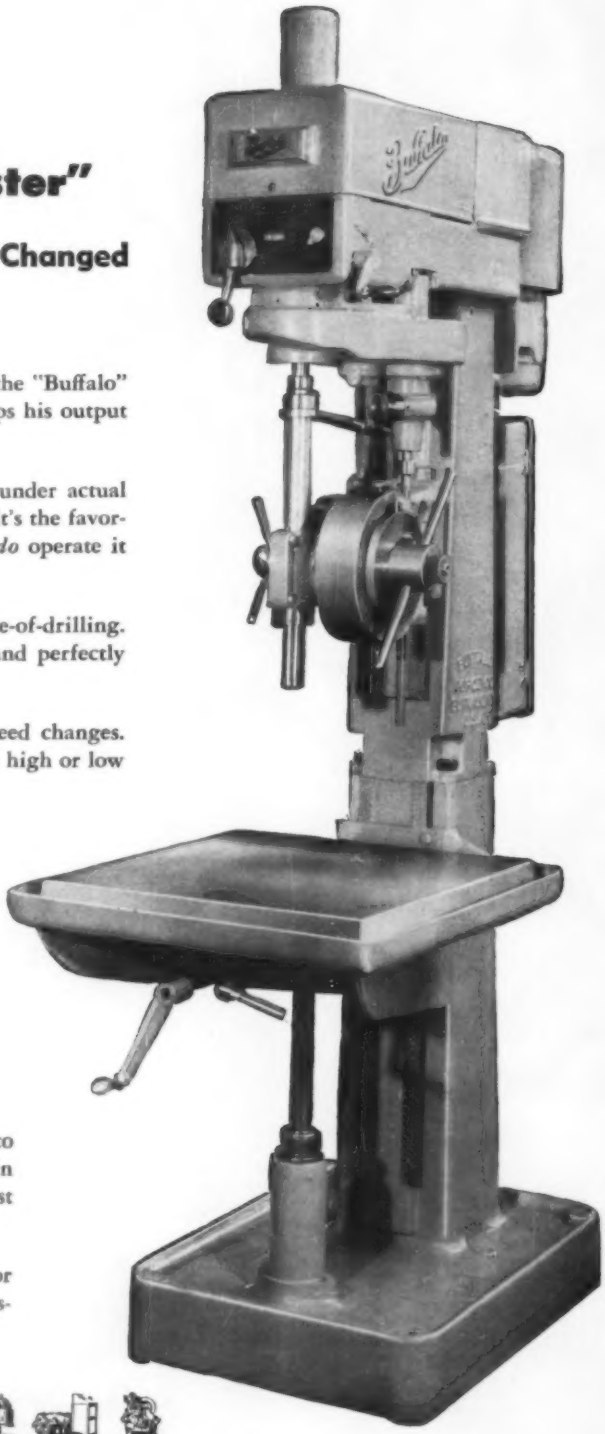
One of these is extreme smoothness, quietness and ease-of-drilling. That's the result of the gearless variable speed drive and perfectly fitted spindle.

Another "RPMster" advantage is the instantaneous speed changes. The shift lever at the left of the head places the drive in high or low range. The dial at the right provides infinite speed variations in either range. These handy controls adjust precisely to speeds ranging from 100 to 3000 RPMs, for all your drilling, reaming and tapping operations.

Sturdily built for a long life of accurate, maintenance-free service, the "RPMster" is available in one- to six-spindle models. And, considering all the unique versatility it can add to your production and shop jobs, you'll find that it's mighty economical, too.

Try the "Buffalo" No. 1 "RPMster", and you'll want to put one or more of these outstanding drills to work in your plant. For a demonstration, contact your nearest "Buffalo" machine tool dealer — or write us today.

The "Buffalo" "RPMster" features the famous "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.



ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

509 BROADWAY, BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

Air portable disc sander using "81 Coat" Speed-Wet Metalite Discs to speed grinding of die-marks on refrigerator front sheets.

New SPUR ACTION abrasive discs give 2/3 more production

Here is the long-sought answer to both production and cost problems . . . new abrasive belts and discs that not only cut faster—but actually last longer on tough production runs. With the "81 Coat" you get "spur action"—hundreds of rougher, tougher cutting spur points per square inch for faster stock removal. And the strongest resin bond ever gives greater endurance to grinding heat. It's breaking all records for longer mileage. Ask your Behr-Manning representative to prove that "81 Coat" Abrasive Belts and Discs outlast all others by 50%.

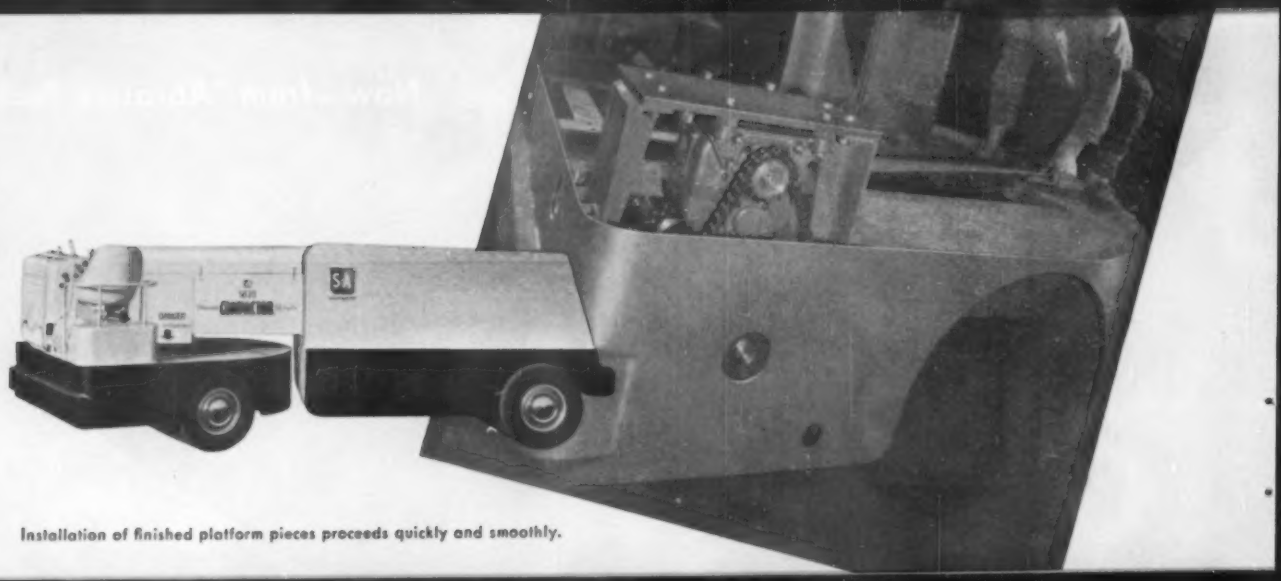
BEHR-MANNING CO.

TROY, N. Y.

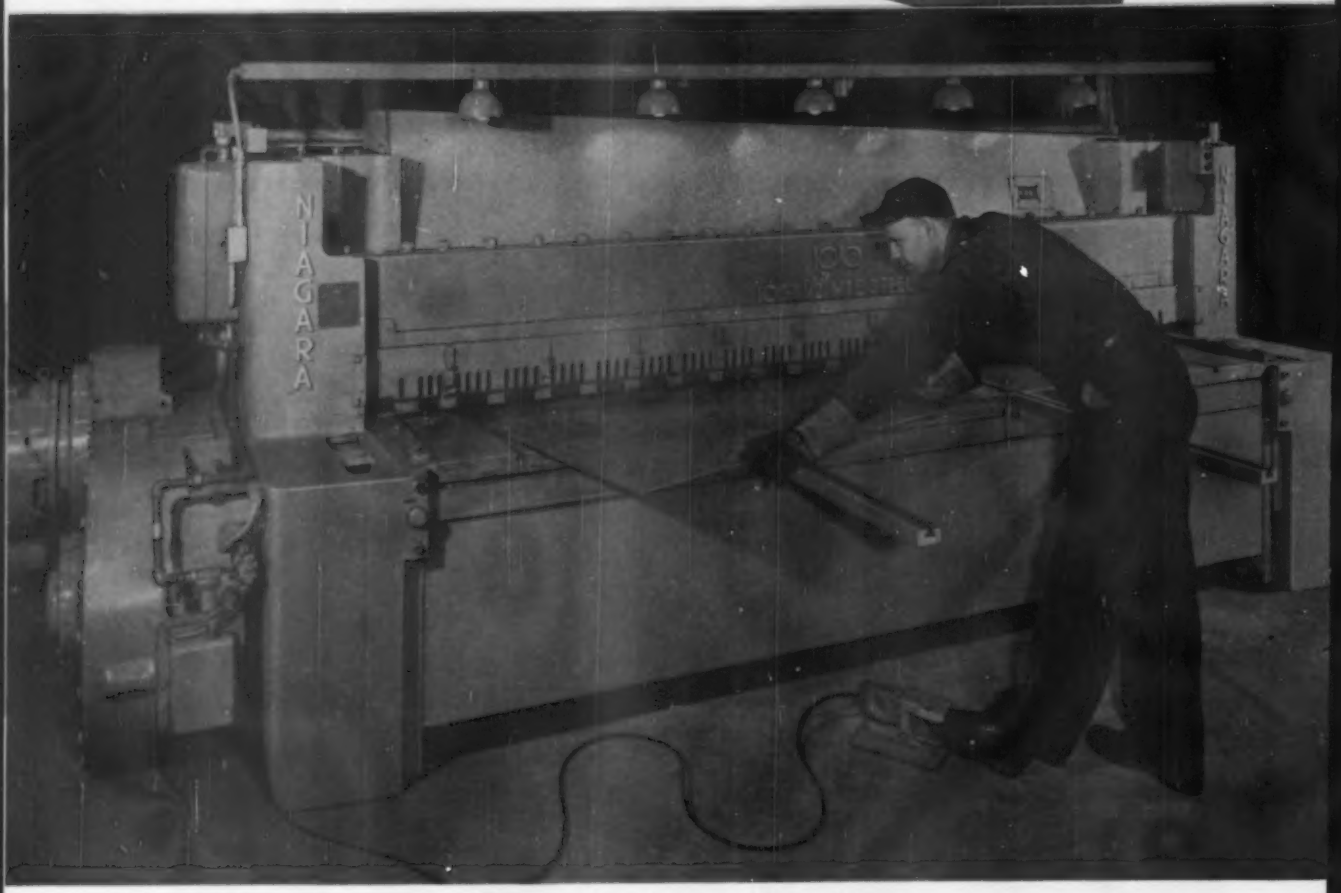
A DIVISION OF NORTON COMPANY

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes
NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories
In Canada: Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., Troy, N. Y., U.S.A.

BEHR-MANNING®



Installation of finished platform pieces proceeds quickly and smoothly.



Niagara Model 1010 shearing 16 gage safety plate for operator's platform of Pneumatic Compactor.

NIAGARA power squaring shears

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

In Canada: Behr-Manning (Canada) Ltd., Brantford. For Export: Norton Behr-Manning Overseas Inc., Troy, N. Y., U. S. A.

"high accuracy ...utmost speed"

...sums up Seaman-Andwall's experience with Niagara Power Squaring Shears

Wisconsin manufacturer of road construction machinery uses Niagara Underdrive Power Squaring Shears to assure high quality and peak production.

Hard at work on America's highways, Seaman-Andwall compactors, rollers and other machines are opening the way to faster, safer travel.

Meanwhile, hard at work in the Seaman-Andwall plant, a Niagara Power Squaring Shear is opening the way to faster, more economical production.

"With Niagara's Shear in operation," says Seaman-Andwall, "we are able to cut 3 to 5 tons of steel per day. *The Niagara Shear gives us a high quality of accuracy with the utmost in speed and performance.*"

Seaman-Andwall is one of numerous plate and sheet metal fabricators who are making Niagara their choice for power squaring shears. And with good reason!

WHEN IT COMES TO ACCURACY, Niagara's positive, power-actuated self-compensating holddown contacts work with low impact, grips metal securely. Rigid, fully closed box section construction of bed, crosshead, holddown and housings resists all stresses with minimum deflection. Gaging facilities are ultra-accurate. Cutting within micrometer tolerances is assured.

WHEN IT COMES TO SPEED, more working strokes per minute, plus instant engagement of Niagara's exclusive sleeve clutch assure more cuts per hour. There's no need to adjust knife clearance for different thicknesses — holddown feet are self-compensating. Fully visible cutting line, ease of operation and quick-setting gages further boost hourly output.

WHEN IT COMES TO STAMINA, Niagara Shears are built to stand up on the toughest jobs. Simple design and minimum number of parts cut costly repairs. Vital drive components operate in a sealed bath of oil.

LEARN ALL ABOUT NIAGARA SHEARS IN THIS PICTURE-PACKED BULLETIN

See Niagara Shears at work in plants across the nation. Observe every feature, every detail. Learn why Niagara Shears can do the most for you. 74-pages — 141 revealing photographs and illustrations! 19 job photo reports! Specifications for 59 standard models. (Capacities: 16 gage to 1" mild steel. Cutting lengths: 4 to 20 ft.)

USE THIS COUPON FOR YOUR COPY BY RETURN MAIL

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y.

Send your new Bulletin 69G on Niagara Underdrive Power Squaring Shears.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

AM

The Federal

No adjustment diddling. Set this gage quicker than you can set your watch. Once set, it *stays* set! *It won't drift.*

No need to keep a stockpile of dials. This 7½" accurately calibrated, *all-usable* scale will answer every normal gaging need. Operator cannot change magnification or monkey with your tolerance specifications. Dimensionair is fool-proof. To meet the occasional finer or coarser measuring requirements, other magnifications are available.

Finger tip attachment. Longer approach range lets you see where you are going. Greater plug clearance for faster, easier gaging — less wear: No scoring or jamming, greater exploration of out-of-round, taper, irregularities. No centralizing error. Deep-set air jets give longest useful life; large and self-cleaning, jets clean work while they gage.

NOTE:
Accurate setting is guaranteed with one master. However, the Dimensionair can be used equally as well *with two* if your standards so specify.

DIMENSIONAIR

This air gage will measure

- **More** Accurately
- **More** Dependably
- **Faster** (Greater Plug Clearance)
- With **Less** Maintenance Cost
- With **Less** Dependence On Skilled Help

than any other air gage you can buy.

This is a statement we are ready to prove. Don't take our word for it. TRY the Dimensionair on a "no-strings-attached" trial basis.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

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71212 Eddy Street • Providence 1, R. I.

OK Prove it! *Let us try a* ***DIMENSIONAIR***

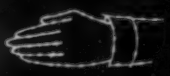
Name .....

Company .....

Address .....

.....

Lodge & Shipley POWERSHIFT PRESELECTOR...

the lathe head with a memory and a helping hand 

GET PRODUCTION PLUS WITH THE LODGE & SHIPLEY POWERSHIFT PRESELECTOR

It's so easy... merely rotate cut speed dial to desired speed (computes the proper speed if required.) Then, when preset speed is needed... shift to it instantaneously at the apron!

SAVES TIME

Even a single change to the proper spindle speed can save important production time. A "compromise" speed setting may waste up to 50% of the machining time on one or more of a series of cuts.

GIVES INCREASED TOOL LIFE

Saving both time and money. Tools last longer and less time is wasted in changing and sharpening tools.

INSURES FINER FINISH

The right cutting speed means a better finish, resulting in greatly reduced or even no grinding... another important saving in time and cost.

CUTS OPERATOR ERROR

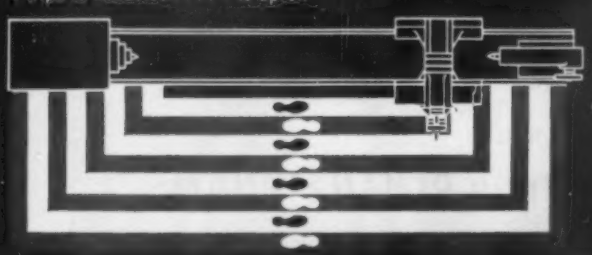
Preselection of cutting speeds saves operator effort and error. One speed can be preset; up to six others "programmed" with handy indicator tabs.

The Lodge & Shipley Powershift is operated by a simple, trouble-free electro-hydraulic system. It's safe, quick and positive... time after time... can be adapted for electronic programming or magnetic tape control for a full range of spindle speeds.

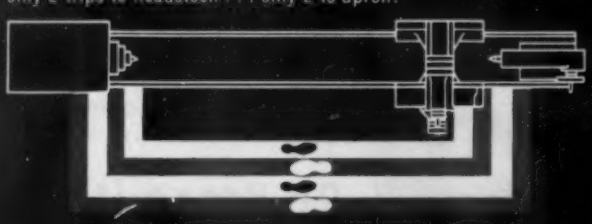
For detailed literature, write: **The Lodge & Shipley Co., 3056 Colerain Ave., Cincinnati 25, Ohio.**

With a long bed lathe and a job requiring 4 speed changes, an OPERATOR CAN SAVE ALMOST 50% OF HIS "HIKING TIME"

CONVENTIONAL HEADSTOCK...
4 trips to headstock... 4 to apron



POWERSHIFT PRESELECTOR...
only 2 trips to headstock... only 2 to apron!

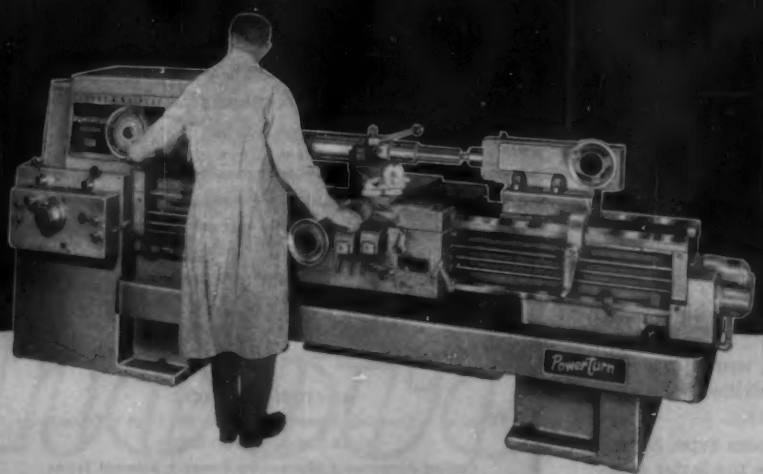


JUST 1 DIAL

computes! remembers! shifts!

steps up production

steps down costs



more than ever before

Lodge & Shipley

your LODGE-ical choice!

Best for every I.D. grinding job you do

Norton wheels spread the "Touch of Gold" across the internal grinding range

High Production At Lowest Cost. Norton wheels for internal grinding are precision-processed for completely uniform structure and identical top performance. There's no fussing with timing cycles when you change wheels.

Money-Saving Precision In Toolroom And Miscellaneous Internal Grinding is assured by the completeness of the Norton line — the right abrasive and bond for every type of job on every type of grinder.

For high production grinding, 44 ALUNDUM*, 57 ALUNDUM, 19 ALUNDUM and regular ALUNDUM abrasives are all quality abrasives at non-premium prices. In particular, the new 44 ALUNDUM wheels have earned high praise from users in many different types of applications. For example:

A Michigan customer reports: *Breakdown was very even, with less glazing, excellent cutting action, and half the dressings needed by standard wheels. "44's" were the best ever used.*

From a New Jersey user the report is: *The "44's" are great for grinding sharp radii, with 30% more pieces per dressing and per wheel, and finish improved from 28 to 15 r.m.s.*

A Pennsylvania customer says "44's" are: *Freer cutting wheels that hold form better, require less dressing and greatly improve finish.*

Whichever of these abrasives you use, team it up with the Norton G Bond, the most efficient vitrified bond ever developed for accurate production grinding.

When your I.D. grinding is the toolroom type, choose 38 ALUNDUM or 32 ALUNDUM abrasive — the latter especially for the more-difficult-to-grind steels because of its outstanding ability to penetrate and hold the cut. And with these two famous abrasives, select G or BE bonds — both vitrified.

Your Norton distributor will gladly arrange a test of these "Touch of Gold" wheels in your plant. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

W-1821

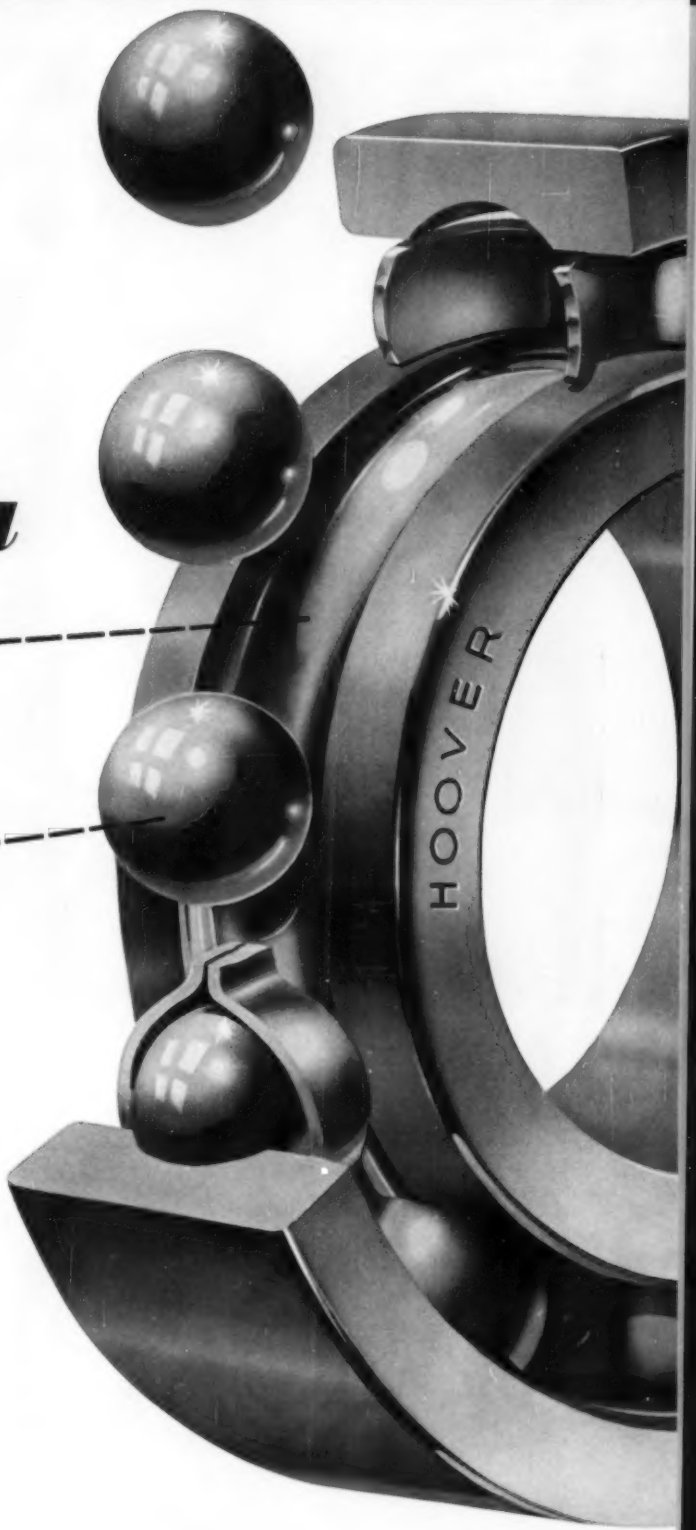
*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS
Abrasives • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION:
Coated Abrasives • Sharpening Stones • Behr-cat Tapes

only hoover gives you



Hoover Honed Raceways

which are not only ground, but also fully honed with a unique process developed and used only by Hoover. The result: super smooth, superbly finished raceways of microscopic accuracy and perfection.

Micro-Velvet Balls

made of the finest of selected high carbon chrome alloy steel, uniformly hardened throughout, then surface finished so perfectly that roundness and diameter are accurate within *millionths* of an inch! The gleaming surfaces are absolutely free of even the tiniest of defects.

Perfectly Matched

ball complements are fitted into perfectly matched raceways . . . a final quality step that pays off in maximum load capacity, hushed quietness and extra long life for which Hoover Ball Bearings are so well known. Bearing types available: single row, single and double shield, combination felt seal and shield, double row, cartridge, single and double contact seal.

Hoover Honed and *Micro-Velvet* are Hoover Trademarks

hoover

BALL AND BEARING COMPANY
ANN ARBOR, MICHIGAN

SALES OFFICE AND WAREHOUSE: 2020 SOUTH FIGUEROA, LOS ANGELES 7, CALIF.

WRITE FOR YOUR COPY OF THE HOOVER HANDI-BOOK OF ANTI-FRICTION BEARINGS.

Keep accurate, concise information at your fingertips to help you select proper bearings and solve bearing problems.

ACCO Registered® Wire Rope Slings

Photo by Cities Service Company

How "Hot" Cobalt is Handled Safely

• Here, encased in a 3-ton lead jacket, is radioactive Cobalt 60 being raised from its deep water storage pool. The tools used to handle this difficult job safely are a Geiger counter and an ACCO *Registered* Wire Rope Sling.

Your own lifting operations may not require a Geiger counter but they do deserve the guaranteed safety that only ACCO *Registered* Wire Rope Slings can offer. How can you be sure that an ACCO sling is guaranteed safe? By the registration certificate and tag that it carries upon leaving the factory. These registered symbols of safety are your assurance that each ACCO sling has passed a rigid strength test at twice its rated load-carrying capacity.

Only ACCO *Registered* slings give you the confidence of DUALOC endings...the double-locked mechanical ending which retains full wire rope strength with either thimble or plain loop.

To learn how ACCO *Registered* Wire Rope Slings can give guaranteed safety to your lifting operations, call your nearby distributor today.

Free Sling Information • Write our Wilkes-Barre office for your copy of new **Folder DH-532,** which gives strengths and weights (for six different lifts) on a full size range of ACCO *Registered* Cable-Laid Slings.

WHAT "ACCO REGISTERED" MEANS

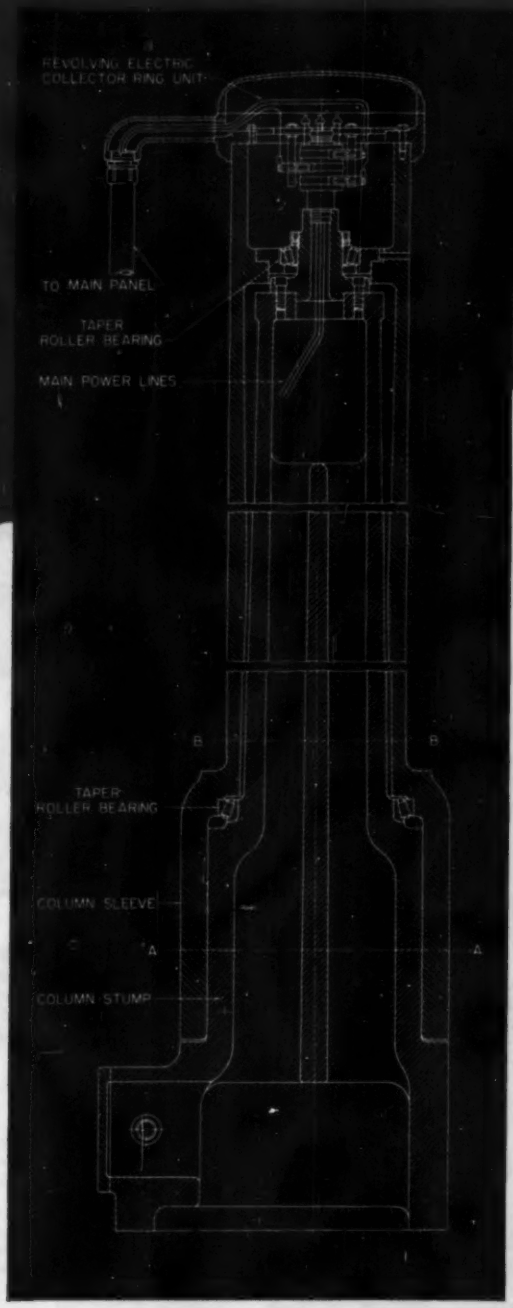
1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification tag on each sling
6. Signed Registry Certificate with each sling

ACCO AMERICAN CHAIN & CABLE COMPANY, INC., WILKES-BARRE, PA.

Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

In Canada: Dominion Chain Company, Ltd., Niagara Falls, Ontario

Rigidity Increased 50%



New thrust resistant, "TIMKEN" mounted column and sleeve assembly.

The new "TIMKEN" mounting of the column and sleeve on the new model 32-speed Hole Wizard Radial has hit the "jack-pot" for rigidity. It's the stiffest, most resistant column unit we've ever known.

Under drilling tests up to 30 horse power deflection has been cut in half over former models. It's truly a marvel of rigidity.

Large Timken bearings at top and bottom when preloaded bind the column and sleeve into the equivalent of a solid unit for resisting functional stresses and cuts arm deflection to an absolute minimum. This definitely results in greater accuracy and longer cutting tool life. To further increase resistance to stresses the column sleeve departs from conventional design by employing a tapered inner wall providing an unusually heavy section where the greatest functional stresses are concentrated.

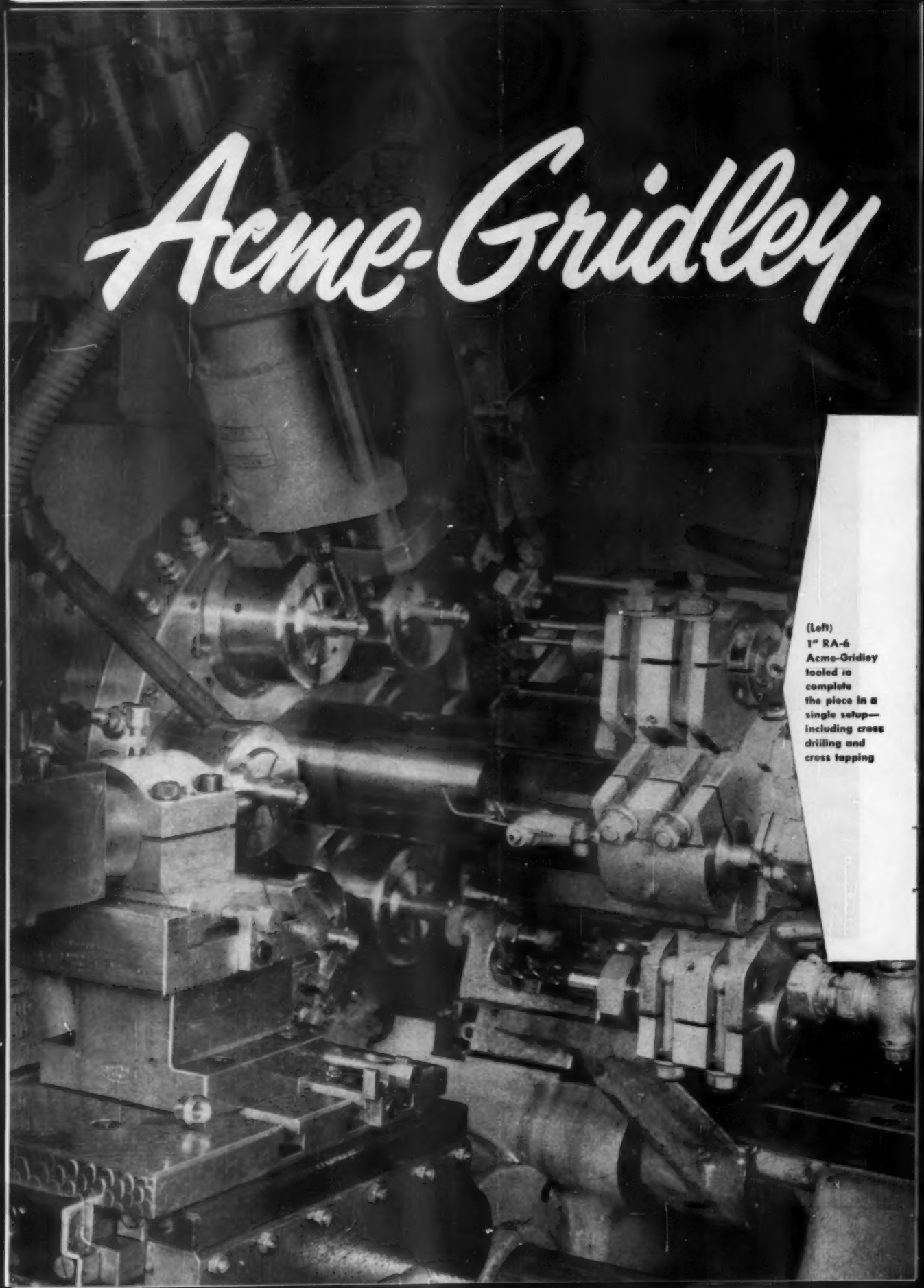
A new "NON-CREEP" clamping mechanism in combination with a solid column sleeve cuff adds greatly to the rigidity of this new "AMERICAN" Radial.

Write for Bulletin No. 328 **for the complete story of More and Better Work at Lower Cost.**

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

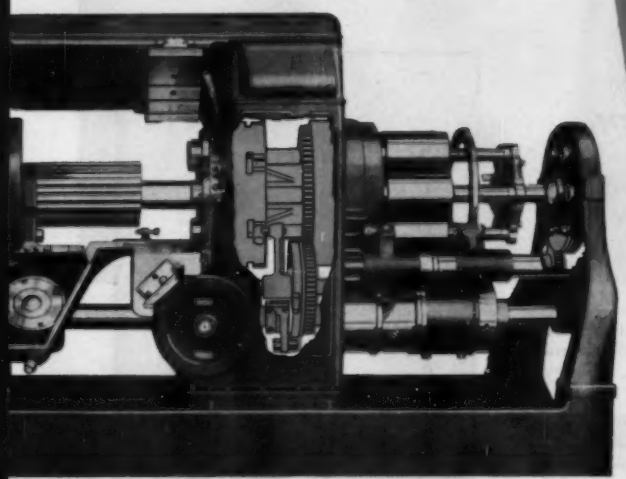
Acme-Gridley



(Left)
1" RA-6
Acme-Gridley
tooled to
complete
the piece in a
single setup—
including cross
drilling and
cross tapping

shockless indexing combined with independently-powered stock reel..

gives greater sustained accuracy... longer machine life



SHOCKLESS, POSITIVE INDEXING of the spindle carrier at high speed is accomplished by a Geneva mechanism. Indexing starts smoothly from a standstill, rapidly accelerates, then decelerates and comes to a dead stop without shock. Accurate location and positive locking of the carrier is assured by the locking pin mechanism.

STOCK REEL IS INDEPENDENTLY POWER INDEXED through a separate shaft and gear. This eliminates torsional strain and any tendency to whipping action, which might cause excessive wear on spindles and spindle carrier.

Acme-Gridleys are at their productive best when performing "secondary" operations during the primary setup—operations which otherwise would require additional time, machine investment, and floor space.

On an Acme-Gridley you can perform operations that require "on-the-button" indexing—such as cross-drilling and cross-tapping in successive spindle positions—with the same fourth-decimal-point-accuracy at the end of the shift as at the start.

And—your Acme-Gridley has power and stamina to spare, at the highest speeds and feeds that modern cutting tools can safely stand.

LET US TELL YOU MORE ABOUT
Acme-Gridley **BASIC DESIGN**

This is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

THE NATIONAL ACME COMPANY • 171 EAST 131ST STREET • CLEVELAND 8, OHIO

SALES OFFICES: • Newark 2, New Jersey • Chicago 6, Illinois • Detroit 27, Michigan

Here's what U. S. Steel Supply's ANY STEEL ANYWHERE ANY TIME SERVICE means to Dray Manufacturing Co.

"Dependable Service from U. S. Steel Supply has

INCREASED PRODUCTION 50%"

says James H. Dray, President, Dray Manufacturing Company, Inc.

"The net result of a 4-year association with U. S. Steel Supply has meant a *proven* 50% increase in our total production," says Mr. James H. Dray, President of the Dray Manufacturing Company, Inc., Downey, California, manufacturer of metal office furniture.

By using U. S. Steel Supply's ANY STEEL, ANYWHERE, ANY TIME SERVICE, Mr. Dray eliminated the need for a voluminous inventory. "We previously carried a $60,000 in-plant stock of cold-rolled steel sheets," he says. "Today, we have less than $16,000 worth on hand, because we have our steel delivered, if necessary, on a day-to-day basis from U. S. Steel Supply—and the increase in available working capital, which had been tied-up in inventory, permitted us to buy additional production equipment *we could not afford before.*

"Secondly," says Mr. Dray, "our reduced inventory also made an extra 10,000 square feet of space available for increased production facilities and machinery." Steel buyers, like James H. Dray, have found that by using ANY STEEL, ANYWHERE, ANY TIME SERVICE it is actually *less expensive* to buy from U. S. Steel Supply.

Why not put this service to work for you?

Your steel needs, regardless of your location, can be handled immediately and accurately by U. S. Steel Supply's ANY STEEL, ANYWHERE, ANY TIME SERVICE. You'll get money-saving, time-saving and problem-solving benefits when you deal with U. S. Steel Supply, *plus* the invaluable experience of our metallurgists, our engineers and our sales representatives.

If you want one of our representatives to help you plan for new efficiency, new economy and new profitability in your future steel buying needs, just write to U. S. Steel Supply at the address listed below.

U. S. STEEL SUPPLY
DIVISION

Mailing Address:
P. O. Box 1099, Dept. W12, Chicago 90, Ill.

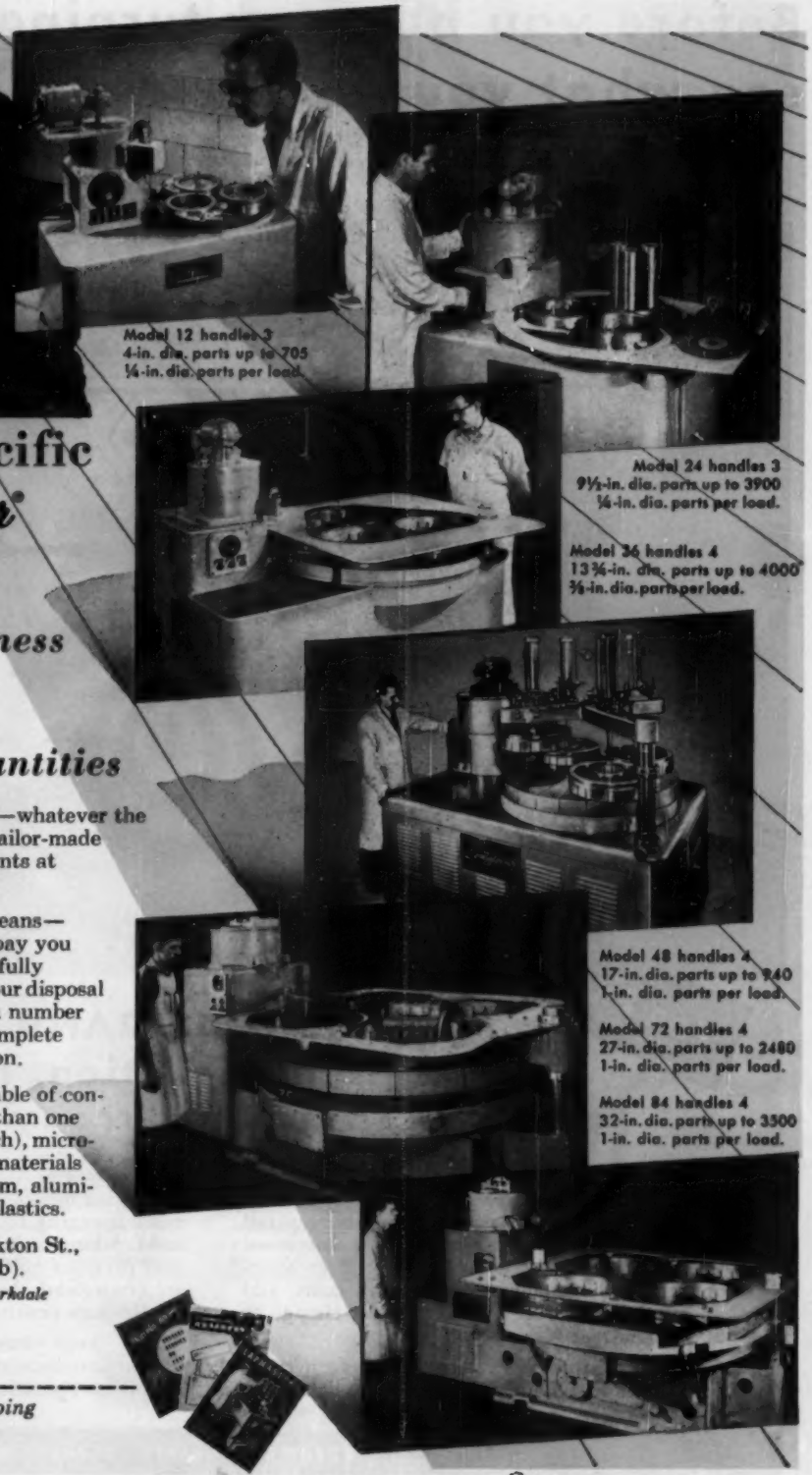
USS

General Offices:
208 So. La Salle Street, Chicago 4, Ill.

Warehouses and Sales Offices Coast to Coast

UNITED STATES STEEL

in this line-up . . .



Model 12 handles 3 4-in. dia. parts up to 705 ¼-in. dia. parts per load.

Model 24 handles 3 9½-in. dia. parts up to 3900 ¼-in. dia. parts per load.

Model 36 handles 4 13¾-in. dia. parts up to 4000 ⅜-in. dia. parts per load.

Model 48 handles 4 17-in. dia. parts up to 940 1-in. dia. parts per load.

Model 72 handles 4 27-in. dia. parts up to 2480 1-in. dia. parts per load.

Model 84 handles 4 32-in. dia. parts up to 3500 1-in. dia. parts per load.

there's a specific *Lapmaster* to give you:

1 *Precision Flatness*

2 *and Finish*

in production quantities

Parts large or small—tall or squat—whatever the case may be, there's a Lapmaster tailor-made to meet your production requirements at the lowest possible cost per piece.

If you are now lapping by other means—hand scraping or grinding—it will pay you to investigate the Lapmaster. Our fully equipped lapping laboratory is at your disposal to analyze your problem, test run a number of pieces and furnish you with a complete production report without obligation.

"John Crane" Lapmasters are capable of consistently producing flatness to less than one light band (11.6 millionths of an inch), micro-inch finishes of 2 to 3 RMS on all materials including cast iron, steel, magnesium, aluminum, brass, carbon, ceramics and plastics.

Crane Packing Company, 6436 Oakton St., Morton Grove, Ill. (Chicago Suburb).
In Canada: Crane Packing Co., Ltd. 617 Parkdale Avenue, Hamilton, Ontario.

Free data

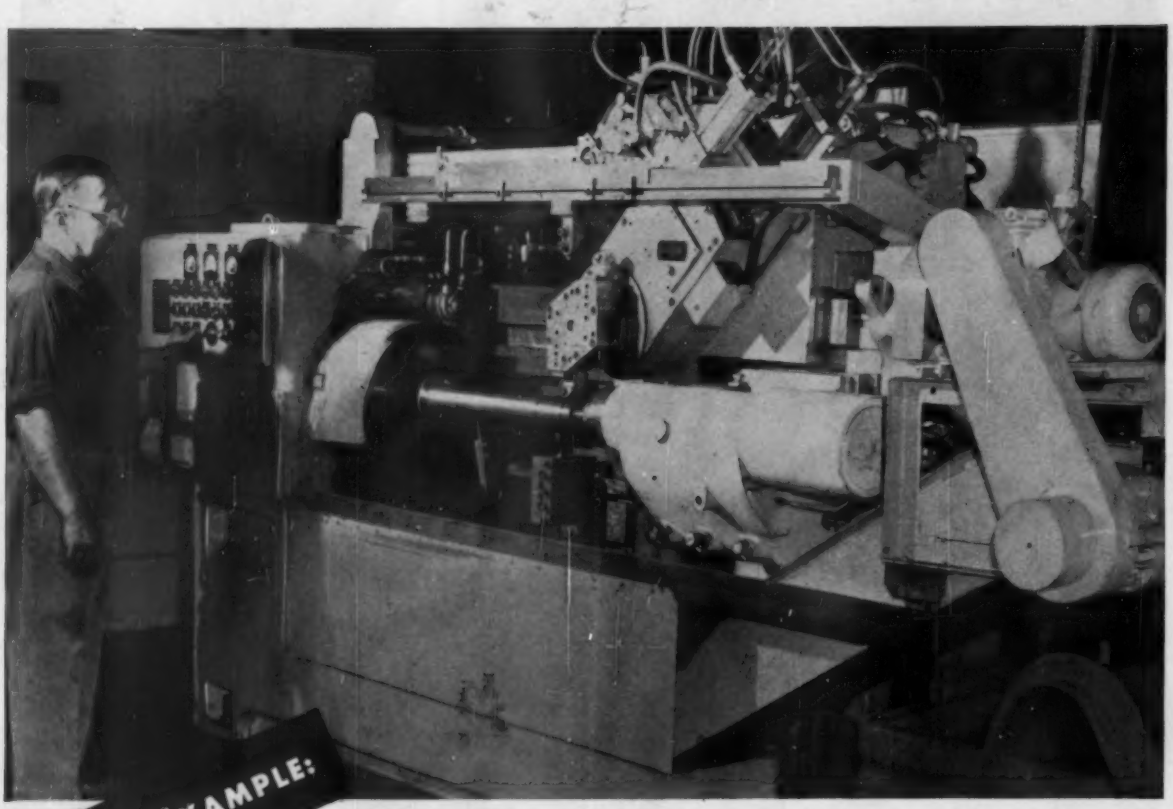
These 3 booklets on Production Lapping and Light Band Reading are yours for the asking. Write today.

John Crane

MECHANICAL PACKINGS | SHAFT SEALS | TEFLON PRODUCTS | LAPPING MACHINES | THREAD COMPOUNDS

CRANE PACKING COMPANY

Before you buy any turning equipment see what you get from SUNDSTRAND



FOR EXAMPLE:

This SUNDSTRAND Tracer Lathe simplified operation, reduced costs and improved accuracy and finish!

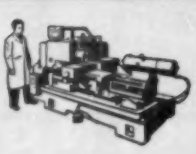
This one Sundstrand Automatic Tracer Lathe installed at International Harvester's Tractor Works replaced two lathes previously required for the turning of bevel pinion shafts. Increased production, reduced set up time, closer tolerances, simplified operation, reduced costs, and finer finishes are the benefits of this change to Sundstrand.

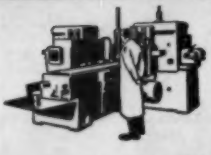
Changeover time was reduced from an average of 8 hours to 1 hour on the multiple small lots turned on this lathe. Rough forgings are ruff and finish turned in one set up using an automatic indexing tool turret equipped with a ruff and finishing tool. Finishes were improved 50% over previous machining method and tolerances are consistently held within the specified limits to eliminate rework.

All of these combined features add up to a production increase, reduced cost and overall simplified operation.

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS



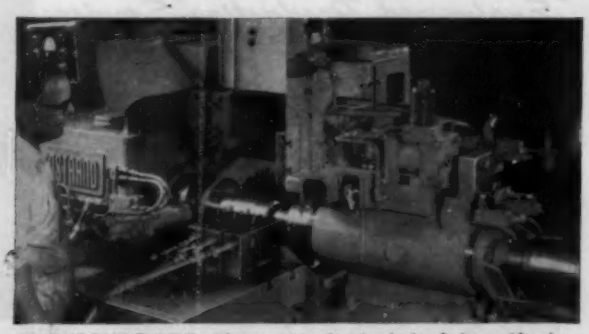


SUNDSTRAND

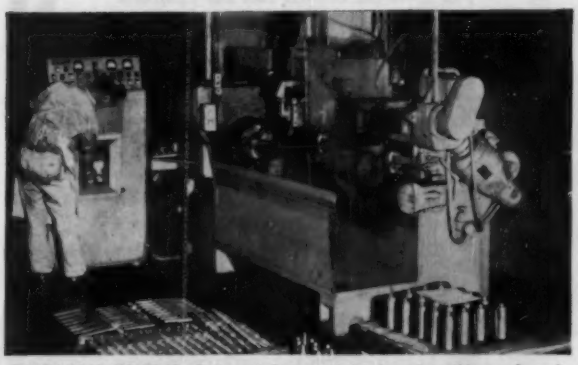
"Engineered Production"

INCREASES EFFICIENCY

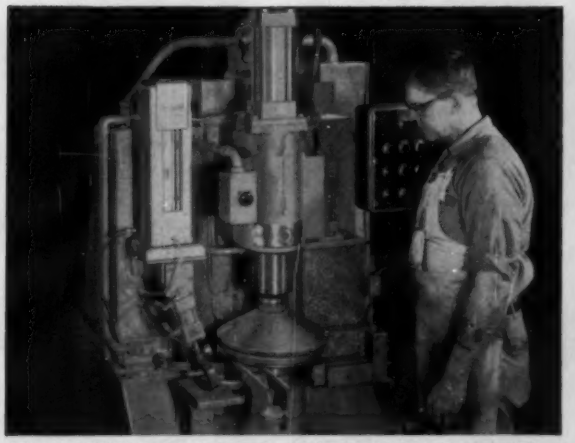
. . . because the choice of the processing method — including the machine and tooling — is based on years of experience in solving every type of machining problem. Because Sundstrand builds a complete range of tracer, multiple tool, vertical and special lathes as shown on these pages, you will obtain the *best machine for your specific needs,* one that includes advanced design ideas for outstanding turning efficiency.



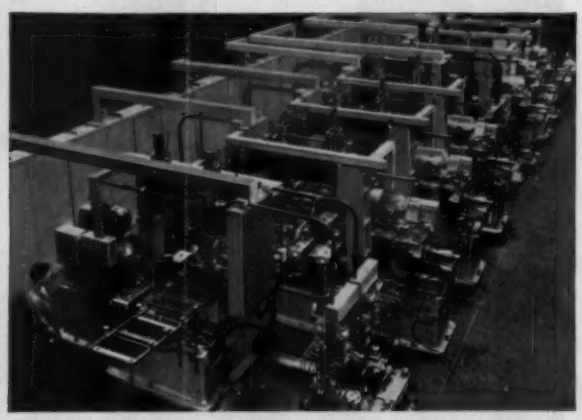
MULTIPLE TOOL TURNING—Where a variety of turning, boring, facing, and forming operations are required on a particular part, Sundstrand automatic lathes can be provided with a combination of tools mounted on front, rear, and overhead carriages, permitting the maximum number of surfaces to be machined in a short machine cycle.



PUNCH CARD CONTROL—A few of the parts being turned on this punch card controlled automatic lathe are visible in foreground. Both setup time and mechanical skill requirements are held to a minimum with this machine while high-quality work is assured.



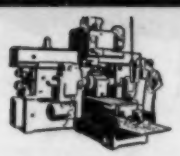
VERTICAL TURNING—This Sundstrand vertical automatic production lathe is basically a standard machine with platens for mounting turning or grooving slides, multiple tool slides, or tracer slides. Floor space requirements are reduced materially, and automatic handling can be applied readily. One operator can readily handle several of these machines.

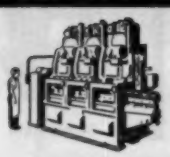


SPECIAL TURNING—Where production requirements are high, Sundstrand special automatic loading process lathe lines, like this one for automotive camshafts, insure high output of top quality work. The part goes through the complete line without any manual handling whatsoever.

More facts about Sundstrand turning equipment are available in Bulletin 186. Write for your copy today.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.

"Engineered Production" Service

FOR BROACHING

It takes all 3

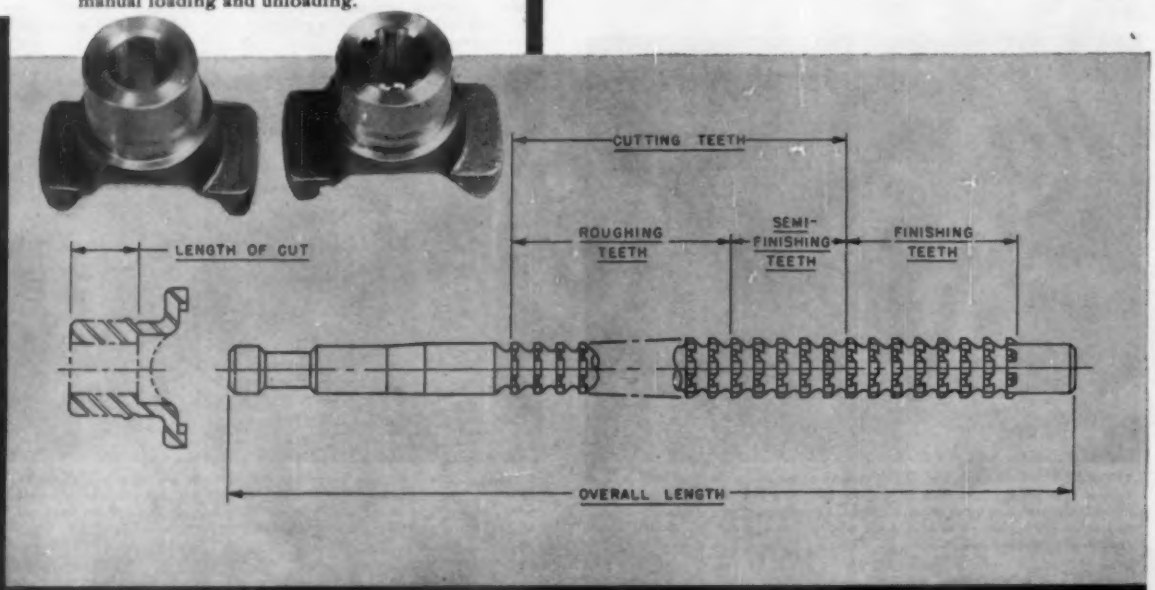
American's "Engineered Production" Service . . . gives the broach user the complete three part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

THE JOB — Broaching splines in two different end yoke parts — four at a time — with a high production rate required.

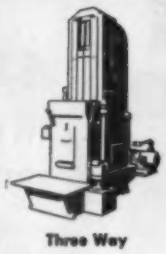
THE RESULT — 480 completed parts per hour in a semi-automatic cycle using manual loading and unloading.

1 PROPER BROACH TOOL DESIGN

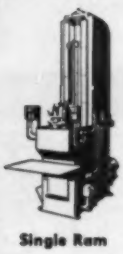
Top quality results on any broaching operation require starting the job with design of the broaching tool. In solving this all important first step, American Broach considers stock removal, length and width of cut, finish, tolerances required, etc. Because the broach and machine are designed to operate as a team, high quality work and long tool life result. In this installation, radial location is maintained between the broach spline and the half round in the opposite end of the parts.



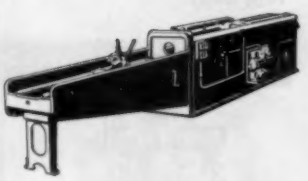
Broaching Tools



Three Way



Single Ram



Horizontal

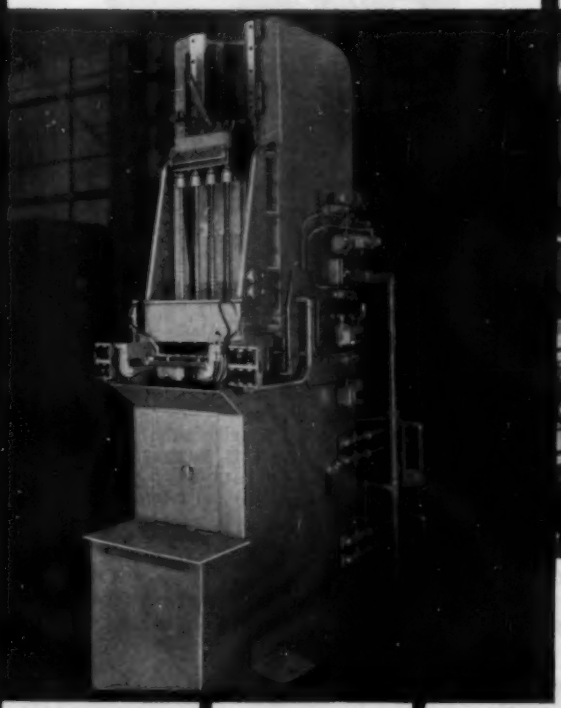
to give you peak broaching performance

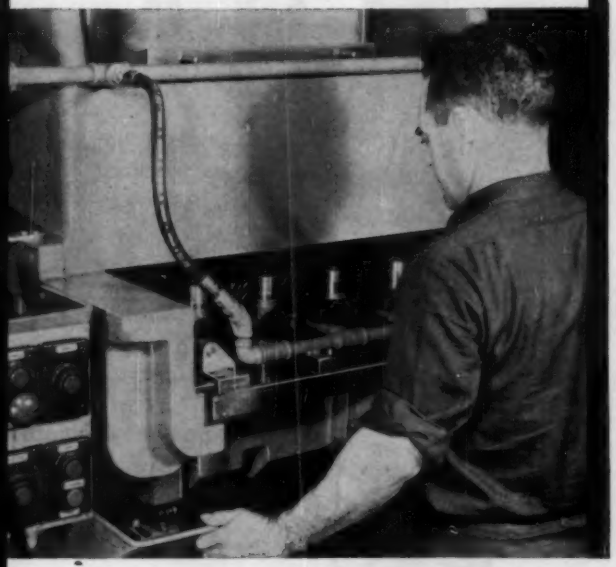
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc., determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. This vertical pull up, 40-ton, hydraulic broaching machine is provided with a variable broaching speed up to 16 feet per minute.

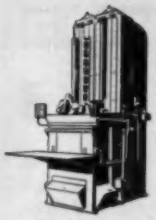
3 EFFICIENT FIXTURING

Whatever your parts geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. The operator unloads and reloads manually at the end of work stroke when work slide moves out with finished parts and broaches return to starting position. This installation again shows how American builds "skills" right into the tool, machine, and fixtures, enabling production schedules to be maintained even with inexperienced operators.





Write for American's Vertical Pull Up Bulletin A121 for more information on practical broaching methods by American.



Duplex Ram

Presses

SUNDSTRAND

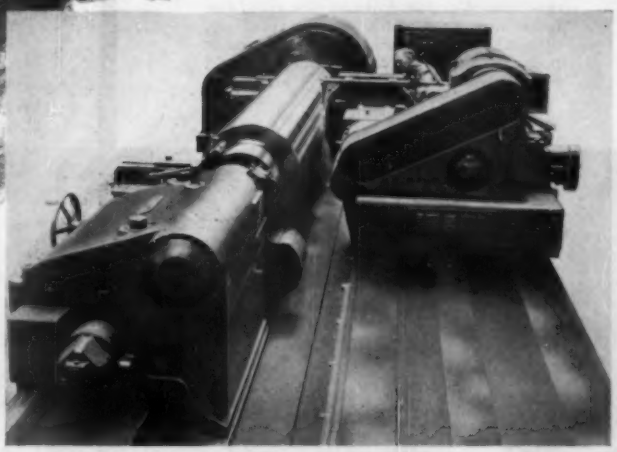
American

BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

He's an expert's expert on roll-grinding!



THE MEANEST PROBLEMS are his meat in a field where it takes a microscope to spot a mistake and half a lifetime of solid, practical experience to know what to do about it.

HAROLD M. "BUN" WALKER gained that experience during 18 years with Jones & Laughlin, Allegheny Ludlum, U. S. Steel . . . 8 more with Bay State in the Pittsburgh area. His field research plus Bay State's lab research, manufacturing techniques and sales engineering have built Bay State's reputation as a major source of supply for roll-grinding wheels . . . all bonds: shellac, resinoid and vitrified.

YOUR PROBLEMS may require more than just a change of wheels. Your Bay State man, like "Bun" Walker, is an experienced specialist in finding practical, economical solutions to *all* basic grinding problems.

Better Grinding at Lower Cost—that is Our Business

BAY STATE WHEELS of PROGRESS

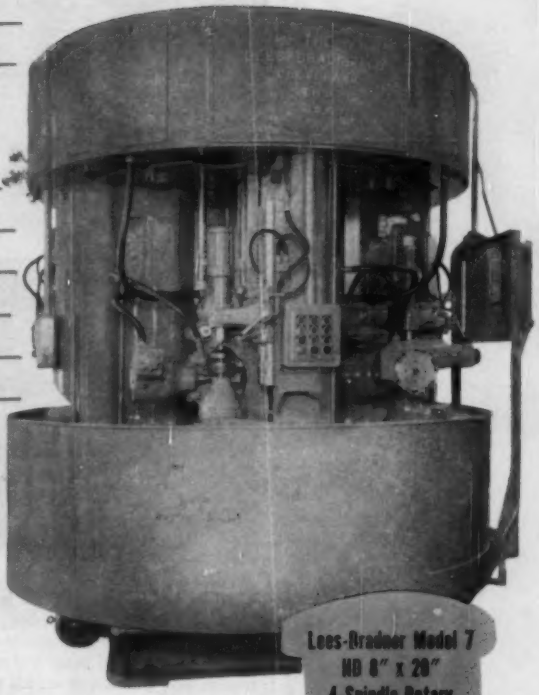
BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
Branch Offices and Warehouses: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh.
In Canada: Bay State Abrasive Products Co. Ltd., Brantford, Ont. *Distributors:* all principal cities.

LEES-BRADNER

Sets the HOBBING pace for tomorrow

with 4 machines in 1



Lees-Bradner Model 7 HD 8" x 20" 4-Spindle Rotary Hobber. Also available in Single and 6-spindle models.

Here's a complete hobbing production line in one space-saving unit.

Actually the Lees-Bradner Model 7 HD 4-Spindle Hobber is four separate and independently operative machines in one. Each hobbing unit incorporates basically the same automatic, high-production features as the remarkable 7 HD Single Spindle Hobber. This includes a heavier, more rugged headstock, heavy-duty column and a 10 H. P. motor.

This amazingly efficient machine not only saves valuable floor space but, with its pushbutton controls and automatic features, actually controls the operator thus reducing the chance for human error or slowdown. Chips and coolant are easily carried away from the headstock by the elimination of flat surfaces.

So, if your manufacturing space is valuable and high unit production important, ask your Lees-Bradner representative to give you the story on the ultra-efficient 4-spindle rotary hobber. Write or wire us direct for his name and address in your area.

View of new HD headstock with increased bearing surface between column and headstock, heavier casting, coolant and chip carry-away.

8-Spindle 7-A Rotary Hobbers also available.

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U. S. A.

REDESIGNED HEADSTOCK is massive, rigid casting, eliminating vibration and assuring maximum accuracy. Electric combination clutch and brake permits fast, smooth starts and stops without overheating. The Gisholt main control (manually or hydraulically operated) and the simple push buttons and feed-stop valves speed changeovers. A wide range of spindle speeds permits peak machining efficiency on all materials.

GISHOLT JETracer (mounted in place of standard front carriage) for either single or multiple pass work. For latter, JETracer will make up to four consecutive, automatic passes from four templates of different lengths and patterns. **Standard rear independent slide** can operate any time within the general machine cycle to complete the part. **Air- or hydraulically-operated tailstock** can be easily mounted, positioned or removed.

High capacity + flexibility = economy

ISN'T THIS WHAT YOU WANT

CONSIDER WHAT YOU CAN DO with this new Gisholt MASTERLINE No. 12 Automatic Production Lathe:

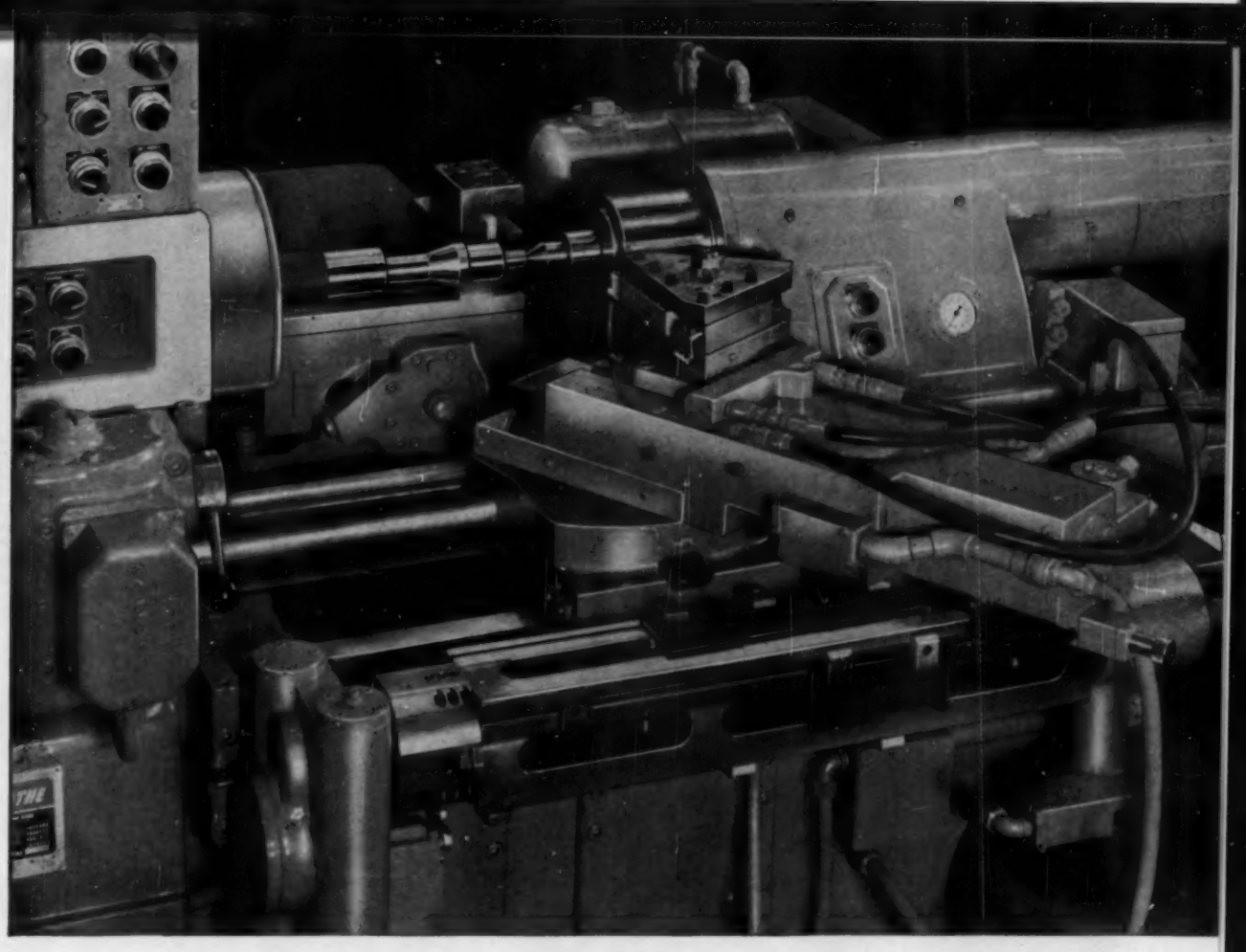
Here is an automatic lathe designed specifically for high production operations—yet this machine is flexible enough to handle a variety of similar parts in small repeat lots.

You can hold work in a chuck or fixture—with a work driver and tailstock—on an arbor or between centers. To start the automatic cycle, your operator simply loads the part, chucks it and raises the Main Control Lever. He is then free to handle additional machines—or to perform other work—until the part is completed.

On the Gisholt No. 12 Automatic, all carriage and slide movements are hydraulically actuated. The front carriage has both longitudinal and transverse motion—or a combination of the two—with quick approach, automatic tool relief and rapid return. You can mount the rear independent slide at any angle to machine bevel gears, drill cones, or handle other parts with angular surfaces.

For special jobs—like machining both ends simultaneously on small motor frames, cylinder sleeves,

MASTERLINE GISHOLT SINCE 1887 GISHOLT



IN AN AUTOMATIC LATHE?

or similar parts— you get even greater flexibility from the No. 12 through auxiliary slides, operated by movement of the standard slides. Or you can mount a back facing attachment within the spindle—for still another way to machine a maximum number of surfaces in one chucking. And for outstanding versatility with great savings in tool and setup costs, the front carriage on the No. 12 may be replaced by a single- or four-pass JETracer slide.

For complete details of the new features on the Gisholt MASTERLINE No. 12 Automatic Production Lathe, call your Gisholt Representative.

WRITE GISHOLT TODAY for advance data on the new Gisholt MASTERLINE No. 12 Automatic Production Lathe. Ask for Form 1178.

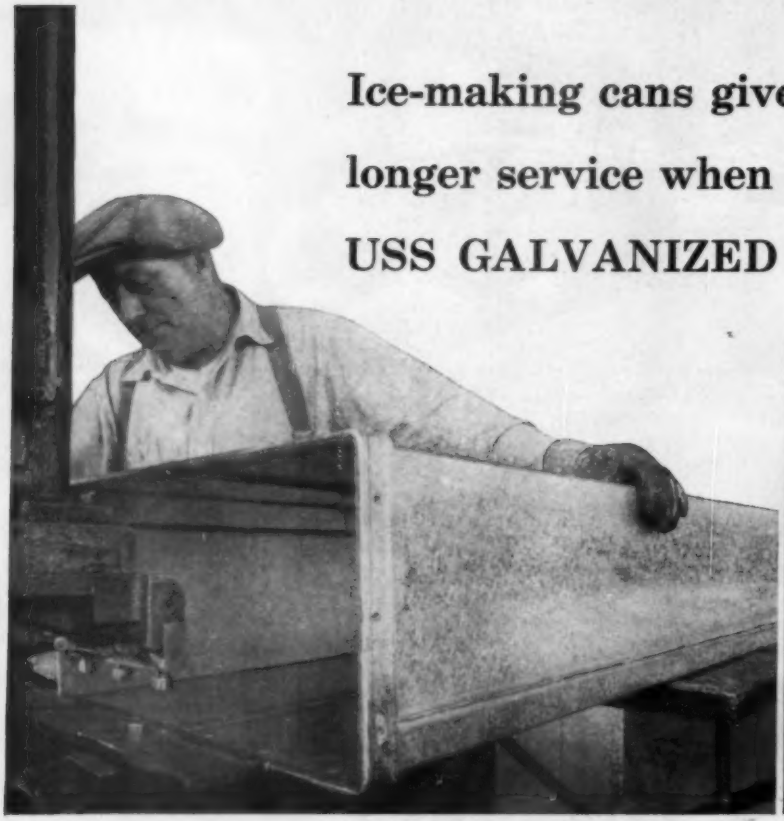
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

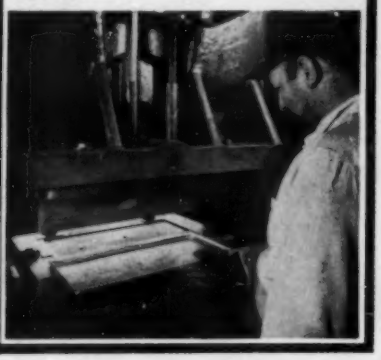
LIKE ALL

Ice-making cans give better, longer service when made of USS GALVANIZED STEEL SHEETS



This 300-pound can, shown during final fabrication stages, uses 14-gage bottom sheets and 16-gage sides of USS Galvanized Steel.

In this heavy press, a sheet of USS Galvanized Steel is formed into the bottom of a large can. The smooth, even zinc coating of this sheet will not crack or chip under this severe forming operation.



Refrigeration is something taken for granted by the average American, yet, ice is needed every day in the handling and also transportation of perishable foods, and is readily available in either block, cubes or processed form from the manufacturer or from vending stations.

The Ohio Galvanizing & Manufacturing Company, Niles, Ohio, has been manufacturing cans to make block ice since 1902, and selling them to an international market. They use USS Galvanized Steel Sheets extensively for the ice cans, and have found these sheets with their tightly adherent zinc coating to be a wise choice. In making ice, these cans are constantly subject to the corrosive effects of water and brine plus damage due to rough handling.

In the manufacture of galvanized steel ice cans as well as many other fabricated items, the need for uniformity of the sheet and the zinc coating on it is answered in USS Galvanized Steel Sheets.

USS Galvanized Steel Sheets are uniform in flatness, ductility, and thickness. They can be bent, cut, stamped, formed, soldered or welded without danger of chipping, flaking or other failure of the coating. For more detailed information on the versatility of USS Galvanized Steel Sheets, get in touch with the nearest District Sales Office of United States Steel.

USS GALVANIZED STEEL SHEETS

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

UNITED STATES STEEL

LIKE ALL

Acme-Gridley

BAR AUTOMATICS

Unusually large tooling zone permits ready access for installation and adjustment of tools and attachments.

All slides are wide and heavy, providing maximum support without overhang.

The NEW 7/16" SIX ...gives you

1. wide tooling versatility
2. high production accuracy
3. long operating dependability

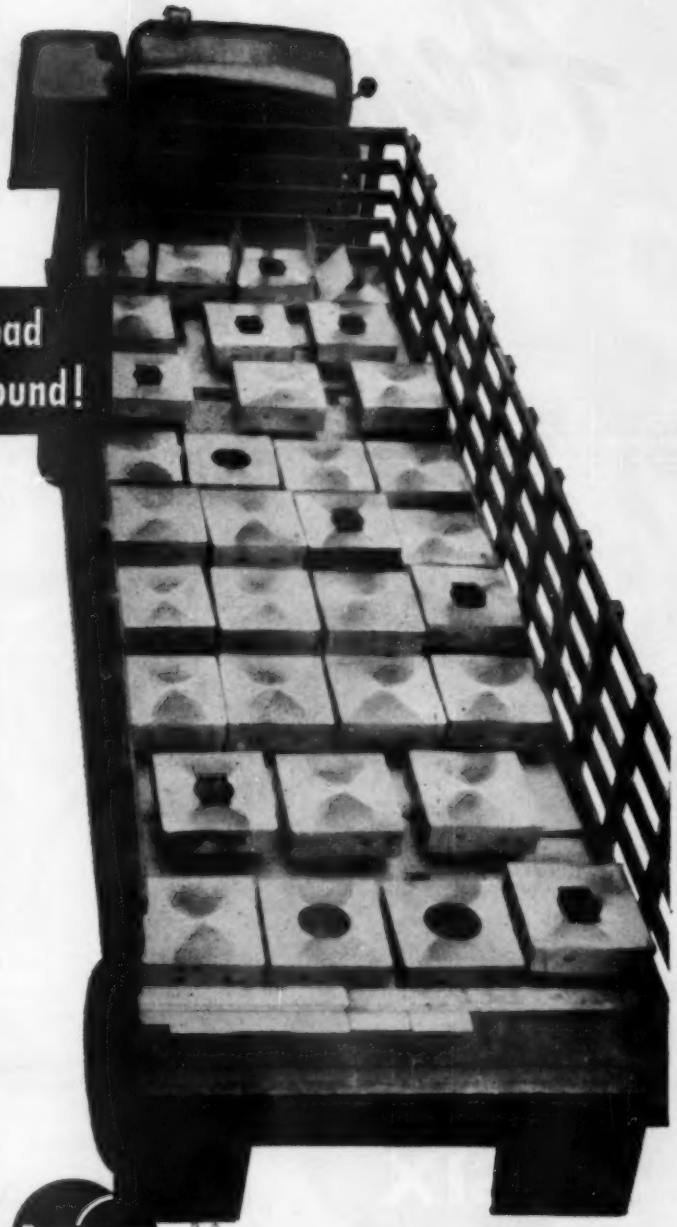
Built to meet the demand for a smaller faster multiple, the new 7/16" RA-6 machine has taken its place in the Acme-Gridley line—chosen by production men who daily prove the advantages of National Acme's "complete line" experience to furnish the right machines for the job.

Write for your copy of Bulletin MRA-56 which illustrates and describes the new 7/16"-Six.

National Acme

THE NATIONAL ACME COMPANY, 171 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

Precision by the Truckload - - they're Blanchard ground!



This truck is loaded with 14 tons of steel. Its cargo is 33 soft steel plates, each measuring 27½" x 25½" x 11.125", and ground to ± .001" on a Blanchard Surface Grinder.

Dies up to 84" across corners, can be ground on a Blanchard at great savings. Grinding can be controlled without guesswork—leaving a flat, sharp die—as soon as the entire surface is cleaned up. Die resharpening on the Blanchard allows you to get maximum life from your valuable dies and end plates.

Ask for details on the 15 standard Blanchard models.

For best results in surface grinding . . .

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS.

THE BLANCHARD MACHINE CO., 64 State St., Cambridge 39, Mass.

Gentlemen: Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd edition) and "Work Done on the Blanchard" (5th edition)

NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

"No wonder Bill looks so worried . . . the shop just ran out of MX Steel"

Smart shops, once they have put USS MX Free-Machining Steel to work, take good care *not* to run out of this faster-cutting screw stock.

For MX Brand, although it costs no more than ordinary screw stock grades, gives them money-saving advantages that they can't afford to pass up.

By increasing the rate of production, *MX Steel lowers the cost per part.* By prolonging tool life, *MX Steel reduces down time.* By providing closer dimensional accuracy, *MX Steel helps to minimize rejects.*

These highly desirable results have been consistently obtained in the production of literally billions of parts—of many different kinds and under widely different conditions. That's why we feel confident that USS MX Steel will cut the cost of any part you now machine from ordinary screw stock.

Remember that USS MX Free-Machining Steel has been successfully machined at speeds up to 350 SFM—speeds far higher than the average (under 250 SFM) used in most shops today.

USS MX Free-Machining Steel is available in both Bessemer and Open Hearth grades and in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, under either the trademark "MX" or his own identifying trade name. In hot-rolled form, MX Steel is available from our district sales offices.

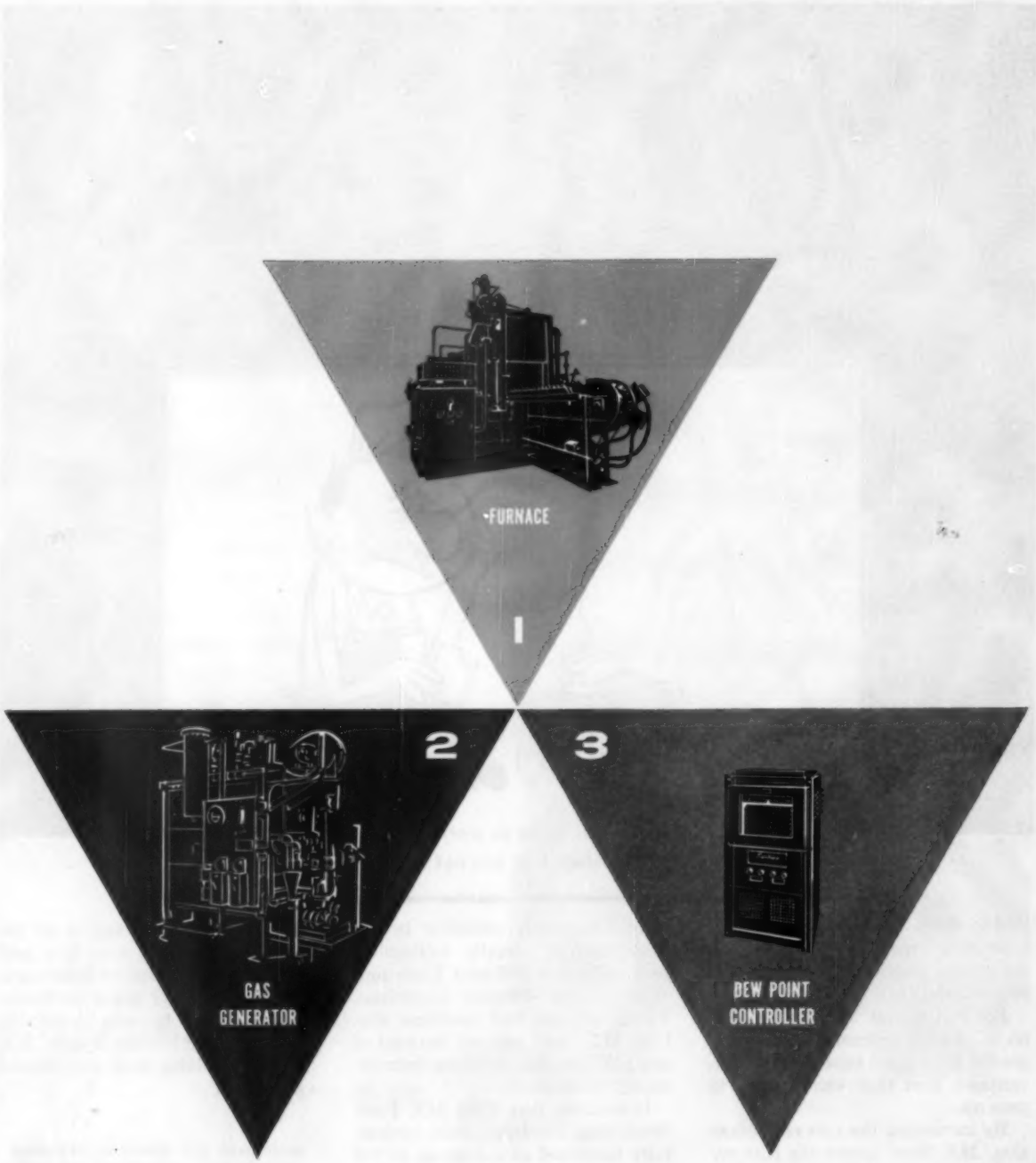
UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION,
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

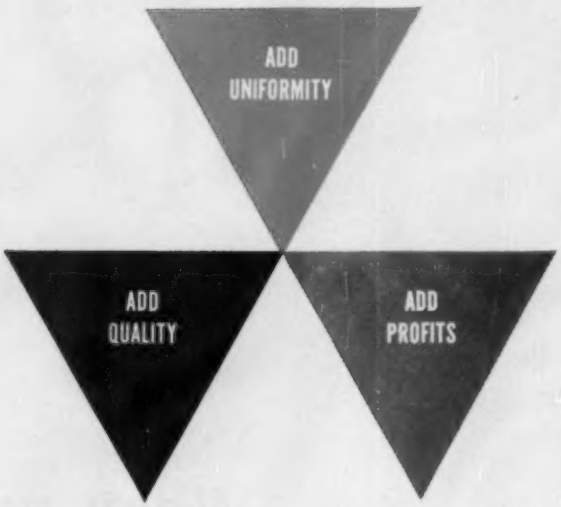
Lower costs . . . bigger output . . . longer tool life

USS *—when you do the job with free-machining* **MX**

Registered trademark

UNITED STATES STEEL


FURNACE
1
2
GAS
GENERATOR
3
DEW POINT
CONTROLLER



UPGRADE STEELS AND PROFITS WITH SURFACE INTEGRATED GAS CHEMISTRY

You can upgrade low-cost steels, and protect metal surfaces to cut cleaning costs with Surface gas chemistry. You can tailor the chemical composition and the physical properties of your metal surface exactly to order.

The process is controllable by instrumentation, and can be easily applied to either batch or in-line operations.

If you use endothermic atmospheres, Surface can supply you a completely integrated system consisting of (1) furnace, (2) atmosphere generator, and (3) controls. Designed to work together, these elements can be as automatic as you want them.

You can improve your profit atmosphere by applying Surface gas chemistry to your heat treating operations. It will reduce costs, improve product uniformity and quality, reduce or eliminate manual labor, and avoid waste disposal problems.

See how Surface gas chemistry has profited others; write for Bulletin SC-178.

Surface Combustion Corporation, 2365 Dorr St., Toledo 1, Ohio. In Canada: Surface Industrial Furnaces, Ltd., Toronto, Ontario.

Surface®

wherever heat is used in industry

for management

When you discover "suddenly

for production men

This Avey machine is used in a jet aircraft plant on the West Coast for drilling, boring, and spotfacing the flanges and periphery of a jet engine component.

The two Aveydraulic units mounted horizontally have 12″ ram travel. The third Aveydraulic unit, mounted vertically, has 16″ ram travel and a 6-speed gear box with a speed range of 150 to 1800 rpm. The vertical column has an in and out traverse of 20″; moves to a minimum of 15″ and a maximum bolt circle of 55″.

The 60″ Electrodex table is equipped with a master index ring with two rows of bushings, 96, 49, and 8 indexes respectively. The three heads can be programmed to the indexing of the table.

Another example of how Avey combines standard units to meet special production requirements.

for management

A single buying decision by a competitor can turn your machines into horse-and-buggy relics, and hang a celluloid collar around your unit costs. Suddenly it's 1906 in your plant. Drastic as this may sound, it is quite possible in this day of modern production equipment which can multiply productivity per man-hour and slice pennies off the cost per piece.

Successful managements realize this, and don't wait for competition to take the initiative. Many of them know that it costs them less to purchase an Avey production machine than it does to keep their old equipment.

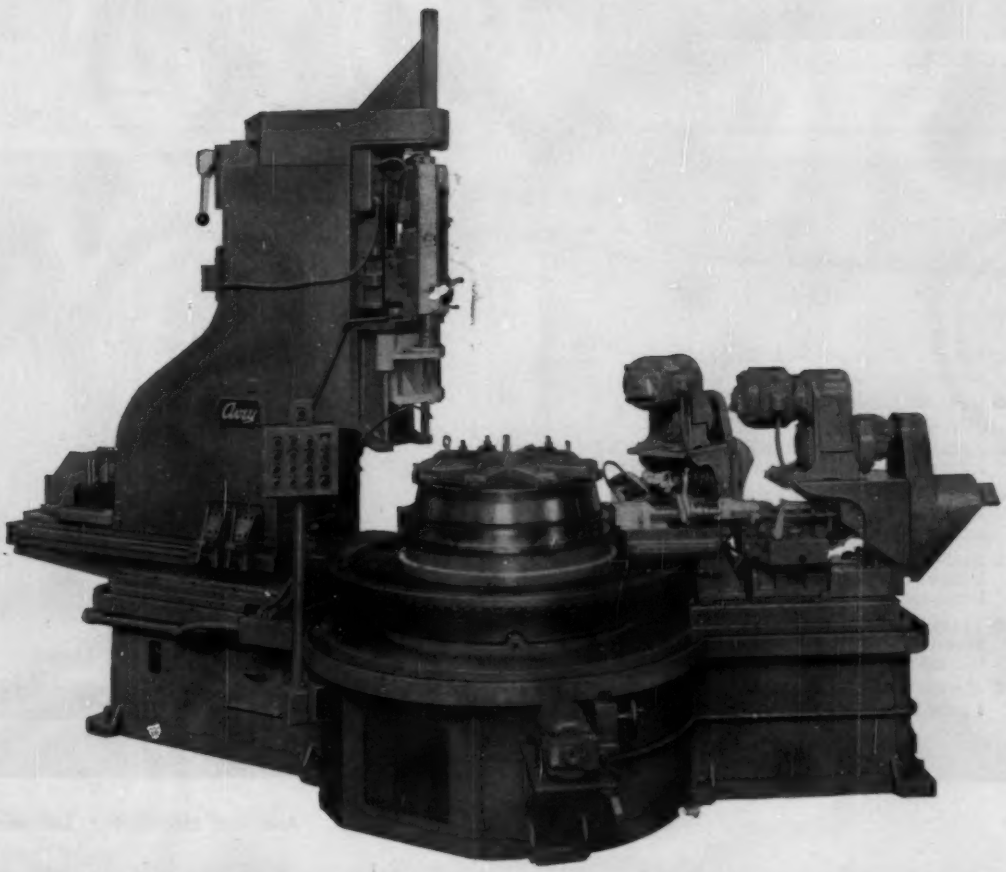
One good reason is that Avey's modular construction permits re-use of units for several different jobs. There are many others which we'll be pleased to tell you about. Avey Division, The Motch & Merryweather Machinery Co., Box 625, Cincinnati 1, Ohio.

drilling, tapping, production machines

it's 1906"

Avey
DIVISION

THE MOTCH & MERRYWEATHER MACHINERY CO.



ALL NEW
CINCINNATI BICKFORD
Lever Shift
• Exclusive HERRINGBONE drive—the only radial built with this advanced feature.
• Pre-loaded, four-bearing spindle and chromium plated sleeve.
• Hydraulic arm and column clamping, special separate motors and complicated electrical controls are ELIMINATED!
• A positive lock-out of the power feed is available. When plunger is operated, it guards against accidental engagement of power feed during tapping or reaming.
• Head-moving handwheel is DE-CLUTCHED when head is traversed by power. Possible operator injury is completely eliminated.
• Two sealed-beam work lights, one on each side of spindle, never get hot . . . impervious to damage from chips and coolant.
• 18 speeds up to 2200 rpm, 18 feeds including 8 geared top feeds.

CINCINNATI BICKFORD

Super Service Radials

MODERN DESIGN and latest engineering developments built in the ALL-NEW Super Service Radial drilling machines give you *higher production . . . faster, safer operation . . . and greater machining accuracy.* Here are a few of the reasons why:

Exclusive de-clutchable HERRINGBONE DRIVING GEAR provides the necessary power to drive large diameter drills and heavy cutting tools for maximum penetration. When higher speeds are used, such as for small taps, the herringbone driving gear is de-clutched, eliminating excessive velocity.

Three head designs available—*lever shift control* of all 36 speeds and 18 power feeds; *complete hydraulic pre-selection* of speeds and feeds; *hydraulic pre-selection of speeds only*—manual control of power feeds.

A positive safety device is provided in the head traverse mechanism to guard against damage should the head strike the workpiece or other objects during traverse. This safety functions *at any point* of head travel on arm. Head-moving HANDWHEEL DOES NOT REVOLVE when head is being traversed by power.

A pre-loaded, four-bearing, chrome nickel spindle and chromium plated sleeve . . . supported in a *honed head bore* over 17" long . . . assure maximum spindle rigidity, *regardless of position.*

The ALL-NEW Super Service Radials are available with 13", 15", 17" and 19" dia. columns, and 4, 5, 6, 7 and 8-ft. arms. For complete specifications on these powerful radial drilling machines, see your nearest Cincinnati Bickford sales representative.

CINCINNATI BICKFORD DIVISION

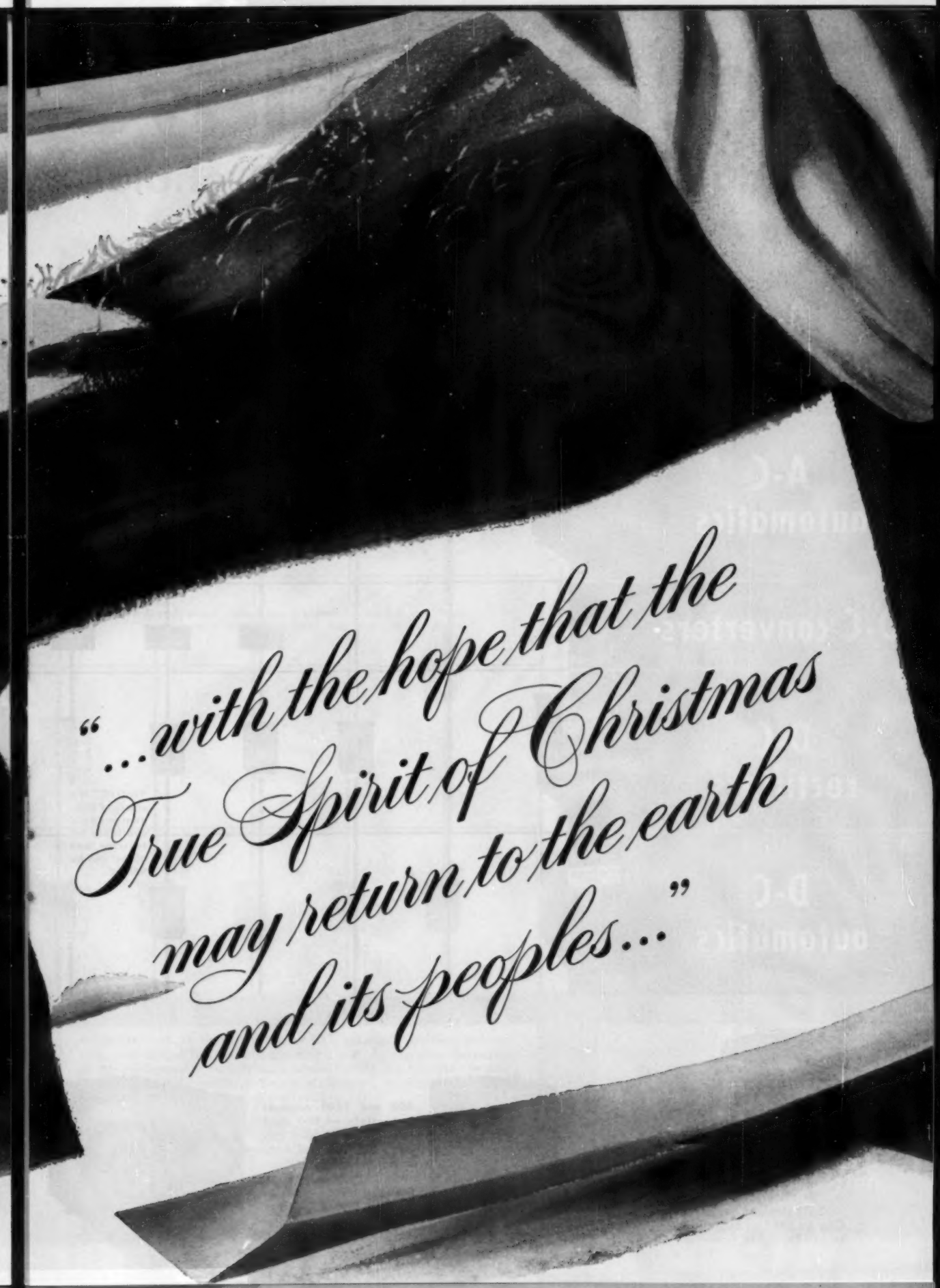
GIDDINGS & LEWIS MACHINE TOOL CO.

CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Upright Gang Drilling Machines, and Precision Production Drilling Machines designed for use with spacing table.

For complete specifications concerning Super Service Radials, ask for Bulletin No. R-35.

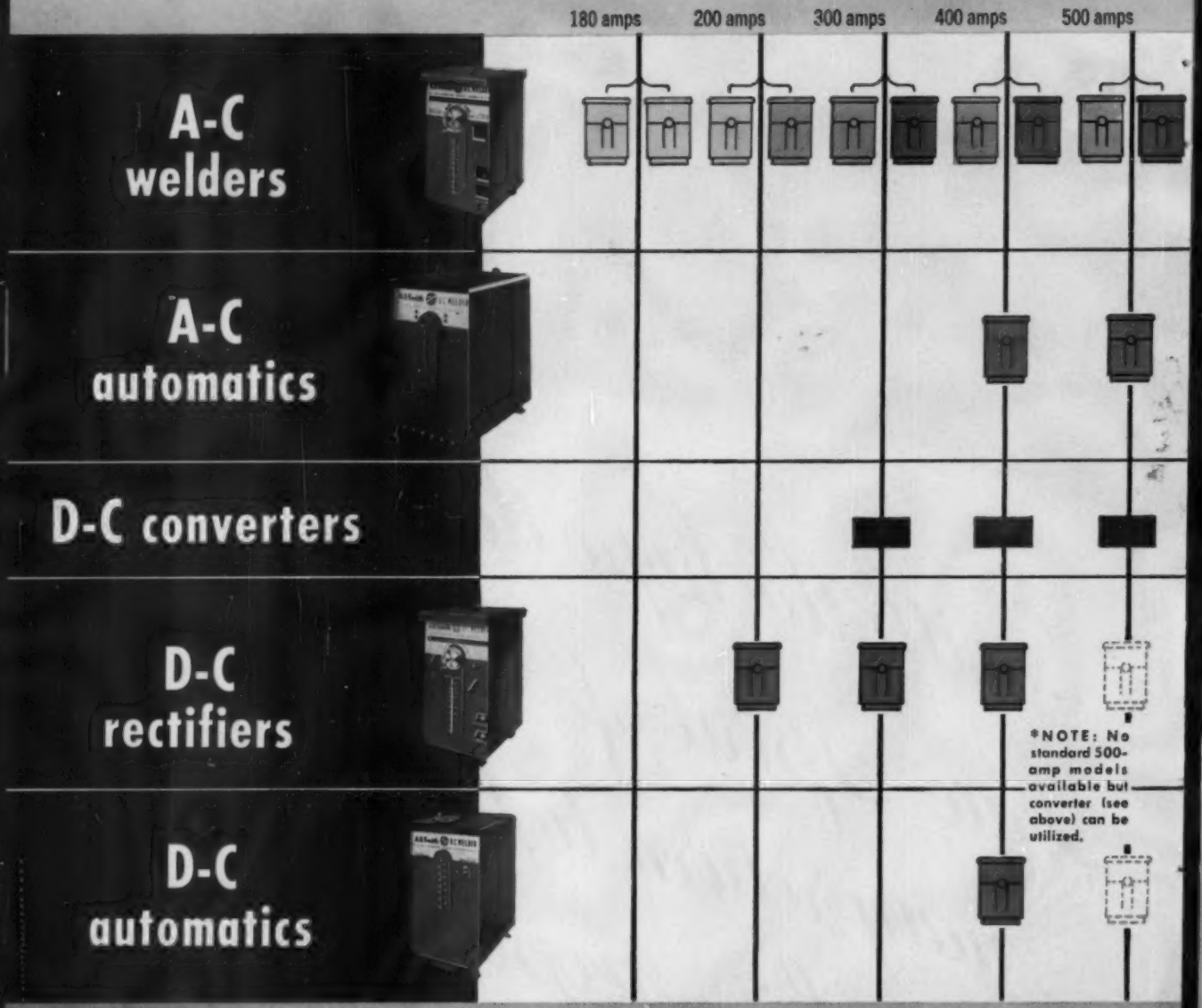
MORSE TWIST DRILL & MACHINE COMPANY · NEW BEDFORD, MASS.
A DIVISION OF VAN NORMAN INDUSTRIES, INC.


"...with the hope that the
True Spirit of Christmas
may return to the earth
and its peoples..."

MORSE TWIST DRILL & MACHINE COMPANY • NEW BEDFORD, MASS.
A DIVISION OF VAN NORMAN INDUSTRIES, INC.

A. O. Smith lays

Industry's most complete choice

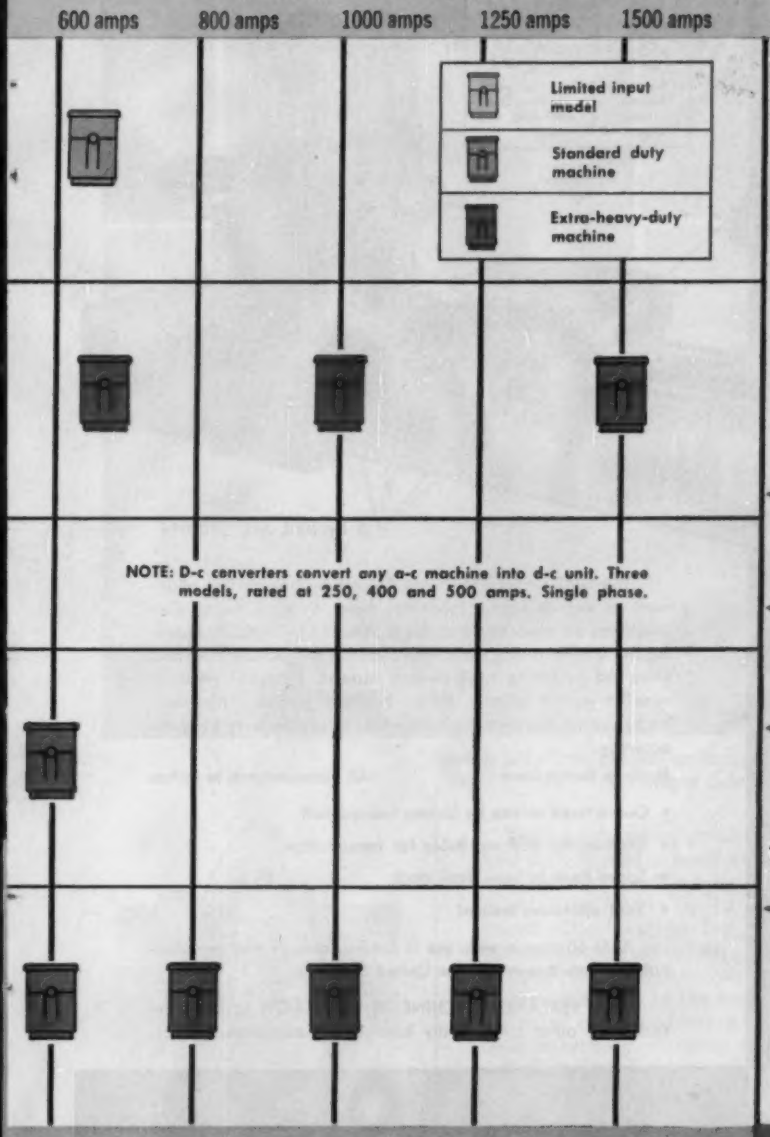


200-amp d-c gas drive — weighs approximately 400 lbs. Handles all electrodes from 1/16 to 5/32 straight or reverse polarity. Can be used as auxiliary a-c power source for lights, power tools, etc.

600 and 1500 constant potentials — 600 amp unit—0 to 45 open circuit volts with fast, easy and precise voltage control. Larger unit offers 80 open circuit volts... handles 10 to 16 welders with grids.

it on the line!

of welding machines


600 amps
800 amps
1000 amps
1250 amps
1500 amps
Limited input model
Standard duty machine
Extra-heavy-duty machine
NOTE: D-c converters convert any a-c machine into d-c unit. Three models, rated at 250, 400 and 500 amps. Single phase.

Limited input models—for farm, shop, maintenance and light-duty repair service — U-180, 180-amp welder and battery charger with dual welding range . . . U-18, same as preceding without battery charger . . . and Model "20S" dual-rated shop welder . . . 200 amps at 50% duty cycle, 295 amps at 20% duty cycle.

"Standard" NEMA a-c welders—Famed A. O. Smith Challenger models in 200, 300, 400, 500 and 650 amp ratings. Last model can be hooked up in series or in parallel. All models except 650-amp unit offer 75 open circuit volts — 650 is rated at 80 open circuit volts.

Extra-heavy-duty a-c welders—This is the elite line of a-c welders, capable of withstanding rough duty that makes other welders fail. All offer full 75 open circuit volts and many other plus features.

A-c automatics — Five basic models . . . 400, 500, 650, 1000 and 1500 amperes. Standard models include primary line contactors. Available with or without automatic/remote current control.

D-c converters — small compact packages quickly and simply convert *any* a-c machine to a d-c unit. Three models — 250, 400 and 500 amps — make *any* machine in your shop a dual welder. A-c or d-c — whatever the job requires.

D-c rectifiers — Here's the most complete line of d-c machines in the industry. All the advantages of m-g sets with none of the maintenance and parts replacement disadvantages. 80 full open circuit volts. Four choices of arc characteristics.

D-c automatics — 6 standard models covering the 400- to 1500-amp range. All feature 80 open circuit volts for more precise arc control regardless of the type of work. Like all A. O. Smith welding machines, they're quality built in every detail . . . are easy to set up, regulate and work with. Primary line contactor is standard. Automatic/remote current control is optional.

Get the complete story on these A. O. Smith machines by contacting your "man from A. O. Smith" or write direct.

C-OMATIC — A. O. Smith's exclusive CO_2 automatic welding process. CO_2 costs only a fraction of helium or argon . . . can save thousands of dollars annually on gas costs alone. Easily set up, easy to use. Includes control console, remote-control stand, automatic head and special A. O. Smith 600-amp d-c rectifier.

C-OMANUAL — Recently introduced CO_2 hand gun version of C-OMATIC (above) puts manual welding on a virtual mass-production basis. Includes lightweight hand gun which automatically compensates for arc length . . . portable control console and special A. O. Smith d-c rectifier.

Through research . . . a better way

A.O.Smith

CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

A. O. Smith International S. A.,
Milwaukee 1, Wisconsin, U. S. A.

Can be used as auxiliary a-c power source for lights, power tools, etc.

DIXI 60

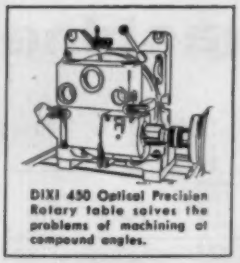
horizontal optical jig borer

The ONLY Horizontal Jig Borer Built Today! Combines the ACCURACY of the Vertical Spindle With the VERSATILITY of the Horizontal Spindle

ACCURATE:
Optical settings provide an overall accuracy of .0002.

VERSATILE:
Optical settings for operations in all planes and compound angles . . . equally suitable for tooling, short-run or production work . . . permits JIGLESS boring, facing, milling and drilling.

PRODUCTIVE:
Saves time, labor & costs . . . Unclamping, positioning, fine adjustment, reclamping and rechecking can be made in less than 10 seconds.



DIXI 450 Optical Precision Rotary table solves the problems of machining at compound angles.

5 OPTICAL MICROSCOPES

The DIXI Optical Reversing Process assures perfect alignment as well as round, taper-free holes. In work pieces with line bores on opposite sides, this is obtained by optically indexing the built-in rotary table 180°, locking the spindle feed and using the hydraulic table in-feed instead. Electrical infinitely variable speed spindle drive; infinitely variable hydraulic feeds; special features eliminate effect of spindle over hang on accuracy.

Made in Switzerland — All measurements in inches

- Guaranteed service by factory trained staff
- Engineering staff available for consultation
- Spare Parts in New York stock
- Your operators trained

DIXI 60 now in wide use in leading aircraft and manufacturing plants throughout the United States.

THIS VERSATILE MACHINE IN OPERATION at our New York, and other conveniently located Demonstration Centers.

Our Headquarters in New York City

MBI

M. B. I.
export & import ltd.

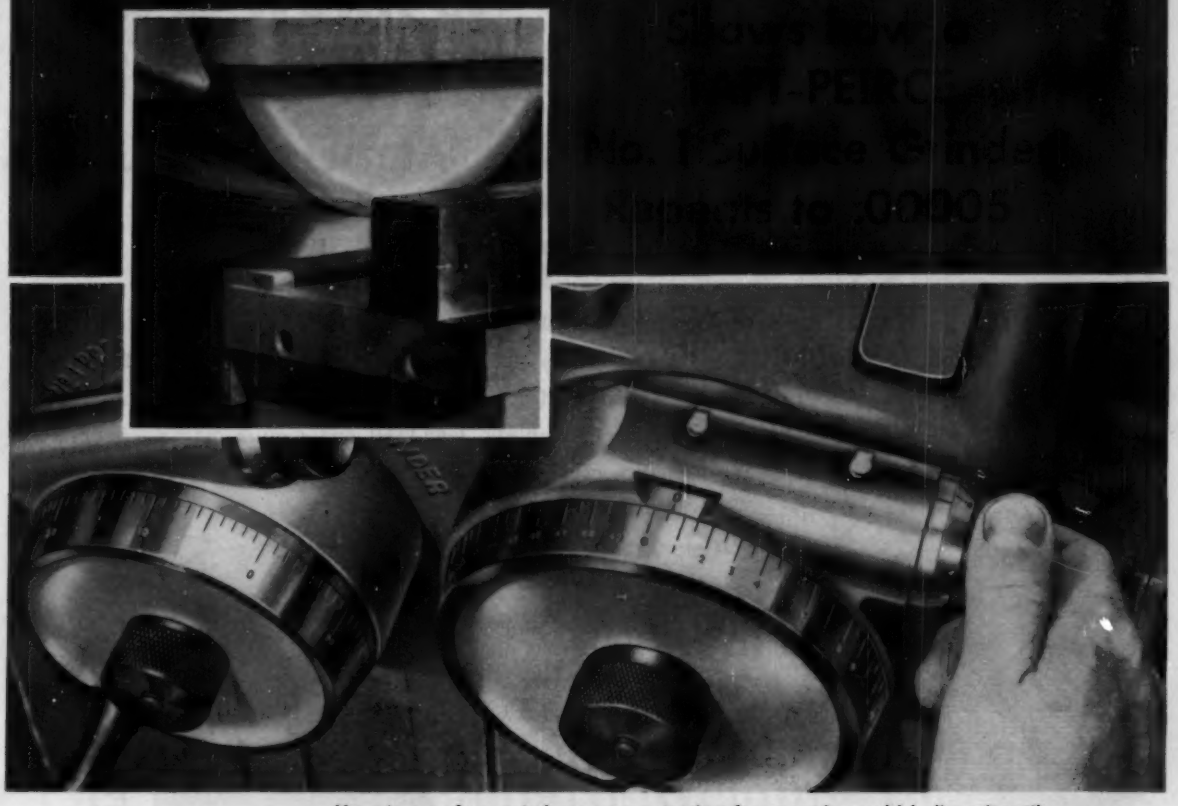
A Division of Machinery Builders, Inc.

475 Grand Concourse, Bronx 51, New York

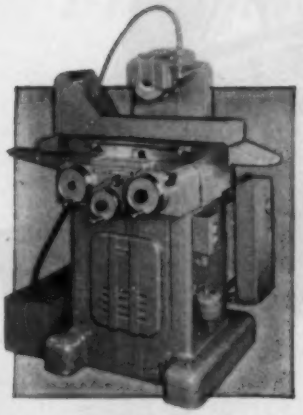
"Over 25 years experience in designing & building machinery"

Milwaukee 1, Wisconsin, U. S. A.

SPARK TEST



Here is a surface grinder so accurate that few people would believe it until this simple demonstration was devised.



This is the Taft-Peirce No. 1 Precision Surface Grinder equipped with permanent magnet chuck, wet grinding attachment, Vernier fine-feed attachments, and J.I.C. electrical controls. A complete line of attachments and accessories makes this the most versatile machine in the shop for every fine tolerance grinding job.

Take a side wheel grinding setup. Grind to a zero reading on the cross feed dial. Move the work away one or two thousandths with the cross feed vernier, then back to its original position. NOTE: There's no grinding spark. Now, feed in ½ of a tenth with the vernier and SEE THE GRINDING SPARK. The identical test with identically precise results can be made to demonstrate downfeed repeatability!

To our knowledge there's never been a standard grinder built before that even comes close to the accuracy of a T-P No. 1 Surface Grinder. An experienced operator frequently can grind to less than .00005" . . . with surfaces so smooth, in many cases, they seal without lapping.

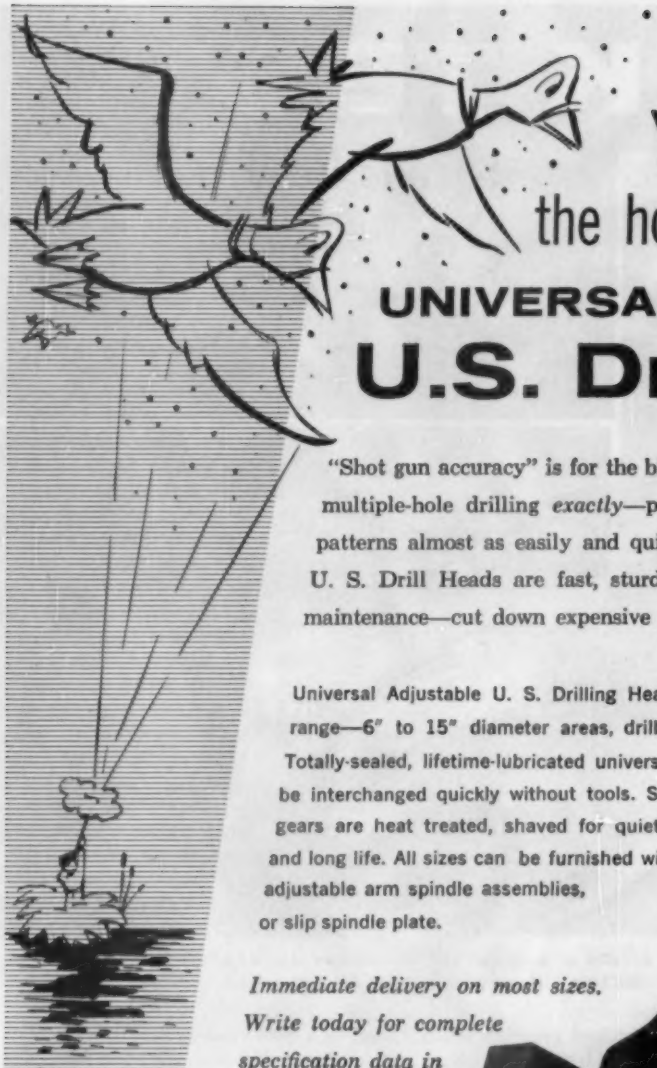
Ball mounted table, roller mounted saddle; and ball tracked column plus ball bearings throughout provide extreme precision and uniformity. Tilting wheelhead simplifies setups. Vernier fine-feed attachments, graduated in .0001" increments spaced ½" apart, are available for either the horizontal or vertical feed.

Compact, yet heavier than other machines, the No. 1 Surface Grinder maintains its accuracy over many years of rugged service. For more information, write for Bulletin No. 317.

TAKE IT TO TAFT-PEIRCE

TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

T-P Means TOP Precision



You **KNOW** where the holes will be . . . with

UNIVERSAL ADJUSTABLE

U.S. Drill Heads

"Shot gun accuracy" is for the birds. With U. S. Heads you pin-point your multiple-hole drilling *exactly*—position the drilling spindles for different patterns almost as easily and quickly as you read them from your prints. U. S. Drill Heads are fast, sturdy, long-lived and require only minimum maintenance—cut down expensive re-operating cost, too!

Universal Adjustable U. S. Drilling Heads cover a wide range—6" to 15" diameter areas, drill sizes up to 1-1/16" Totally-sealed, lifetime-lubricated universal joints can be interchanged quickly without tools. Stub tooth gears are heat treated, shaved for quiet operation and long life. All sizes can be furnished with adjustable arm spindle assemblies, or slip spindle plate.

Immediate delivery on most sizes. Write today for complete specification data in new catalog No. AD-57.

Style U-1L Universal Adjustable Head provides 9" diameter drilling area.

FOR MEN WHO KNOW DRILL HEADS BEST, IT'S ALWAYS U.S. DRILL HEAD...5 to 1.

We manufacture all types of adjustable, fixed center and individual lead screw tapping heads. Ask us to help solve your multiple drilling and tapping problems.

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

▸ Get Mallory Standard Welding Electrodes From Your Mallory Welding Distributor

When you're looking for ways to cut costs in resistance welding, call on your nearby Mallory Welding Distributor. He carries the most complete line of standard resistance welding electrodes ever offered. And he can help you select standard, delivered-from-stock electrodes for many fabricating jobs for which you may have been using expensive, custom-made tooling.

In the Mallory line are fluted and round hole Elkaloy®-A and Mallory-3® electrodes in all three standard Morse taper shanks . . . dome, flat and center-insert Elkonite®-faced electrodes...5 types of socket electrodes . . . flat and centered male and female threaded Elkonite-faced electrodes with Elkonite shanks . . . and 24 types of irregular electrodes of various dimensions and tapers.

The complete line is described in Mallory's new catalog of standard resistance welding electrodes. Ask your Mallory Welding Distributor for your copy. If you are not yet acquainted with a Mallory Distributor, write Mallory for the name and address of the one serving your area.

OVER 30 YEARS OF RESISTANCE WELDING LEADERSHIP

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

Serving Industry with These Products:

Electromechanical — Resistors • Switches • Tuning Devices • Vibrators
Electrochemical — Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical — Contacts • Special Metals • Welding Materials

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

Checking circularity of valve components at the Eli Whitney Metrology laboratory

DIAGNOSIS and TREATMENT of Servo Valve Disorders

After wrestling diligently with the problem of slippage or leakage, an aircraft servo valve manufacturer turned to the Eli Whitney Metrology Laboratory for help. Scrap rate had climbed to 50% and deliveries had become critical.

A precise laboratory analysis for geometrical values revealed not one but three defects—all slight but nevertheless potent.

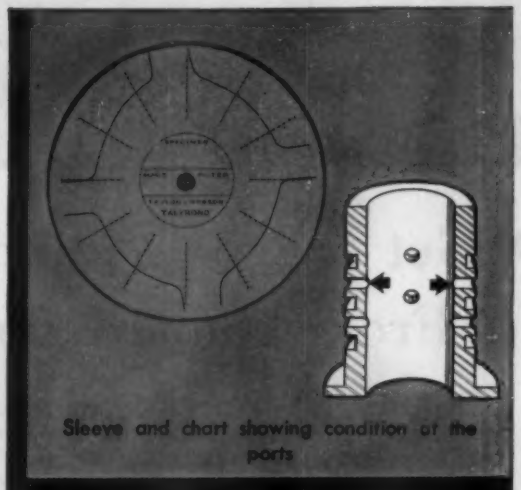
1. A washed out condition in the sleeve bore around the ports
2. piston lands lobed
3. land surfaces too rough for this type of service

This analysis indicated the necessity for changes in processing. These were made and scrap rate dropped immediately from 50% to 4%.

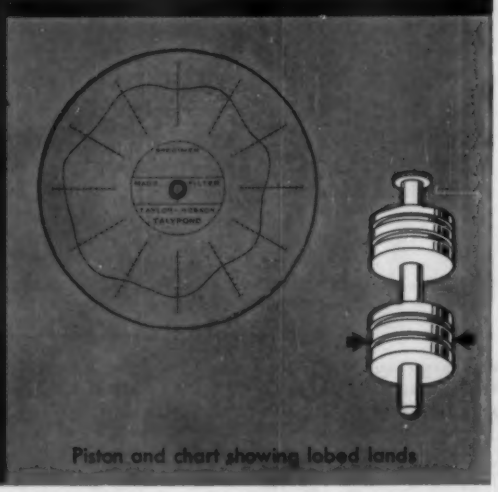
This is just one of many production problems solved by Eli Whitney Metrologists and industrial consultants. This staff has the experience, the instrumentation and the ideal environment for high precision dimensional analysis. This combination of facilities is found in no other commercial standards laboratory in this country.

If you have some vexing problem, ask for Bulletin ML 1-56. Write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 1.

7911



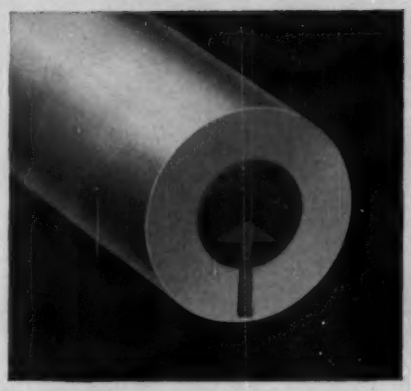
Sleeve and chart showing condition of the ports



Piston and chart showing lobed lands

the SHEFFIELD corporation
of Bendix Aviation Corporation
metrology and measurement for mankind

a hole here makes waste...



a hole here saves waste

Crucible Hollow Tool Steel cut sections eliminate the waste and cost of drilling out solid rounds to make ring-shaped or tubular steel parts, or tools with a center hole. By using these hollow bar sections, cut to length, you do away with unnecessary cutting, drilling, and boring operations, increase machine capacity, and cut scrap losses.

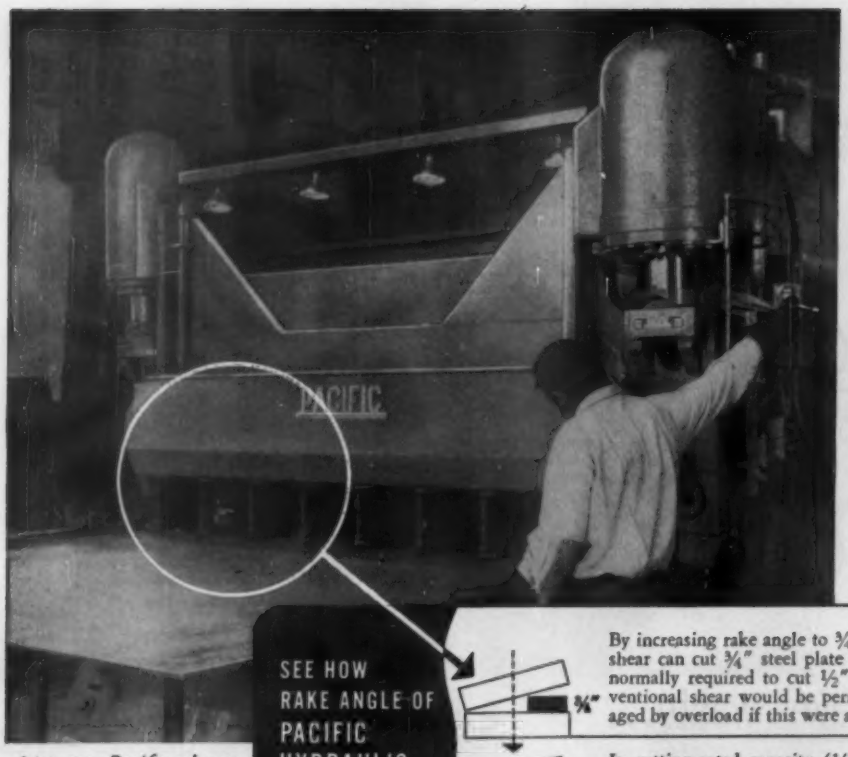
These hollow sections, in just about any O.D. and I.D. combination, or thickness you want, are *immediately* available in five most popular Crucible grades: KETOS oil hardening, SANDERSON water hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air hardening, and NU DIE V hot-work tool steels.

Call your nearby Crucible warehouse for more information, or for speedy delivery. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.



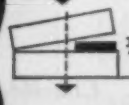
Adjusting Pacific rake angle by hand control lever

NOW...

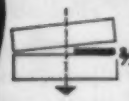
a ½" shear adjustable to cut full length ¾" plate continuously*

SEE HOW RAKE ANGLE OF PACIFIC HYDRAULIC SHEAR IS CHANGED FOR PERFECT SHEARING OF ANY THICKNESS OF METAL

By increasing rake angle to ¾" per foot the shear can cut ¾" steel plate with the force normally required to cut ½" plate. A conventional shear would be permanently damaged by overload if this were attempted.



In cutting rated capacity (½"), **shear cuts** exactly the same as conventional fixed rake angle shear.



In cutting 3/16" steel, the rake angle is reduced to 3/32" per foot and the shear will cut strips 24" long up to 60 per minute with less twist and bow than with any conventional shear.

ABOVE, RIGHT: *¼" plate cut with Pacific adjustable rake shear*

ABOVE, LEFT: *¼" plate cut with conventional shear*

Rugged Pacific Hydraulic Shear cuts steel from 20 gauge to ¾" plate with optimum knife clearance. The knife clearance can be adjusted in 30 seconds to match plate thickness. Pacific Hydraulic Shear cuts noiselessly without shock. Knives last 2 to 3 times longer . . . maintenance downtime from blade changing is greatly reduced. Pacific Hydraulic is the safest shear. The ram, controlled by a portable foot pedal, can be stopped instantly at any point throughout the stroke in an emergency. Pacific Hydraulic cannot be damaged by overload. Independent time studies confirm that it will equal or out-produce any mechanical shear.

*with optimum knife clearance.

PACIFIC HYDRAULIC SHEAR

Mfg. by
PACIFIC INDUSTRIAL MFG. CO.
848 49th Ave., Oakland, Calif.
Plants: Oakland, Calif. and Mt. Carmel, Ill.

DISTRIBUTORS:
LOS ANGELES—Tornquist Machinery Co. • PORTLAND—Portland Machinery Co. • SEATTLE—Buckner Weatherby Co. • SALT LAKE CITY—Todd Machinery Co. • DENVER—Richard Ives & Co. • HOUSTON—Butcher, Carter & Preston Co. • DALLAS—Machine Tool Associates • TULSA—Martin Machinery Co. • KANSAS CITY, DES MOINES & ST. LOUIS—Meshlenpoh Engr. Co. • NEW ORLEANS—Dixie Mill Supply Co. • NORFOLK—Tidewater Supply Co. • PHILADELPHIA, BALTIMORE—Calco Machinery Co. • NEWARK—G. M. Pearse & Co. • PITTSBURGH—Steel City Tool & Machinery Co. • BOSTON—Wigglesworth Machinery Co. • ROCHESTER—Macaulay Machinery Co. • CLEVELAND—Wigglesworth Machinery Distributors • INDIANA—Harry B. Green Machinery Co. • CHICAGO, MILWAUKEE—The Gute Co. • DETROIT—Taylor-Thompson Machinery Co. • MINNEAPOLIS—The Gute Co. • LOUISVILLE—Harry B. Green Machinery Co. • ALBUQUERQUE—Richard Ives & Co. • CANADA—Williams & Wilson Ltd.

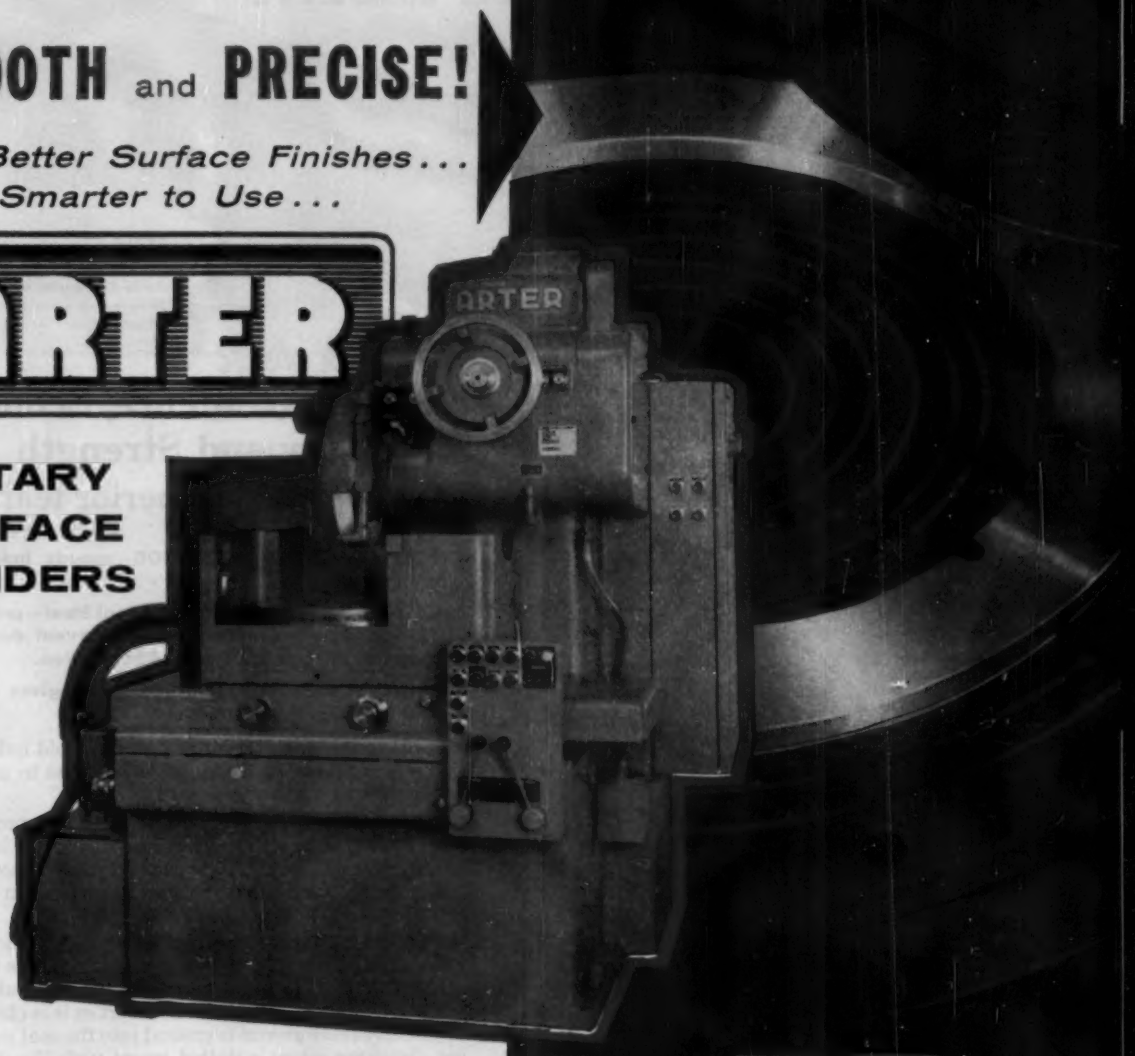
Arter Rotary Surface Grinders are scientifically designed to provide extremely smooth, remarkably accurate micro-plane surface finishes. The basic feature responsible for these close tolerance, superior finishes is the relation of the grinding wheel to the work. With Arter machines, the grinding is done on the peripheral or outer edge of the wheel while the work is held on a rotating magnetic chuck. This results in extremely fine, concentric finishes so necessary for most component parts used in industry today.

SMOOTH and PRECISE!

For Better Surface Finishes...
It's Smarter to Use...

ARTER

ROTARY SURFACE GRINDERS



Illustrated above is Model E, one of a complete line of Arter Precision Rotary Grinders available in chuck sizes from 8" to 40". Each Arter Grinder features completely automatic grinding cycle . . . building block design for ease of maintenance . . . rigid vibration free construction . . . hydraulic controls . . . variable stepless speeds for both chuck and wheel slide traverse . . . manual and automatic feeds . . . adjustable worktable for concave and convex grinding . . . rotatable magnetic chucks . . . and centralized push-button control panel.

For complete details on Arter Rotary Surface Grinders call your Arter representative or write for free brochure.

ARTER

ARTER GRINDING MACHINE COMPANY

Manufacturers of
Rotary Surface, Internal, External Grinders and Arter **JIGMATIC** *Positioning Table*

15 SAGAMORE ROAD, WORCESTER 5, MASSACHUSETTS

New ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS

STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD—speeds indexing of Inserts.**
- **REPLACEABLE SEAT of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.**
- **SHANK of Heat Treated Alloy Steel—gives extra strength and rigidity.**

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

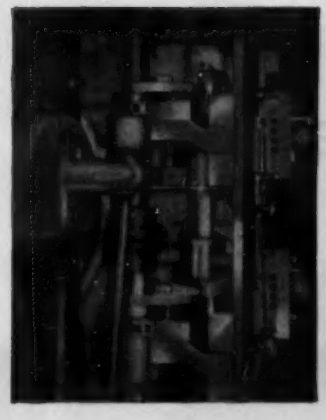
Buy **ARMSTRONG TOOLS** from your Industrial Distributor

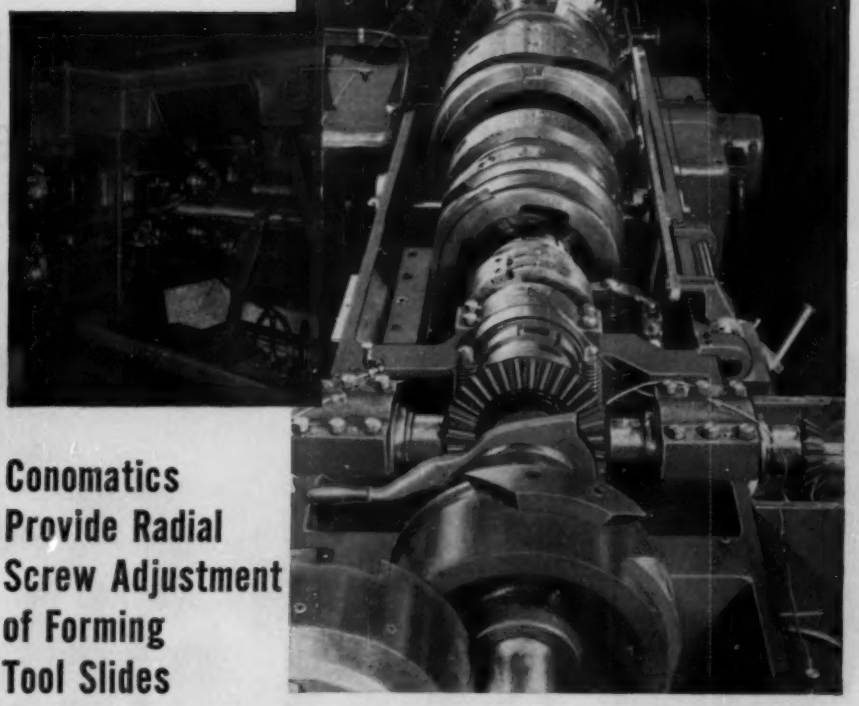
Write for catalog

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**



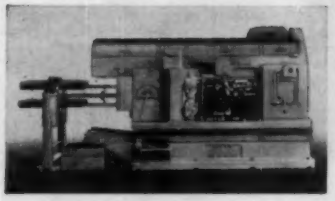


Conomatics Provide Radial Screw Adjustment of Forming Tool Slides

Models 2⅝" LA, 3½" AD, 5" KL, and 5¼" KR Conomatic Four Spindle Bar Machines are equipped with a number of quick job-change features. One of these is the all-position end attachment drive for the mounting of endworking opposed spindles in all positions, with independent feed to as many as three opposed spindles on a single setup.

Another feature that is of considerable importance in tooling up is the radial screw adjustment of all sideworking slides. Trial cuts may be taken to correct diameters with form tools without changing the clamped positions of the form tool holders.

All Conomatic quick changeover models are equipped with dial adjustment of the working stroke of all tool carrying slides. Besides the Four Spindle machines there are three quick change Six Spindle models in 9/16", 1" and 1⅝" sizes. Write, wire, or phone for literature.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

SOME OF OUR
USMIL USERS

T. R. DREYER, Vice President—Brooklyn Manufacturing
American Machine & Foundry Company

a man who came to Fair Street

"The JIGMIL Technique enabled us to establish new manufacturing methods which provided greater accuracy, improvement in our product, substantial reductions in assembly time, and major reductions in machine time, all without investment in jigs."

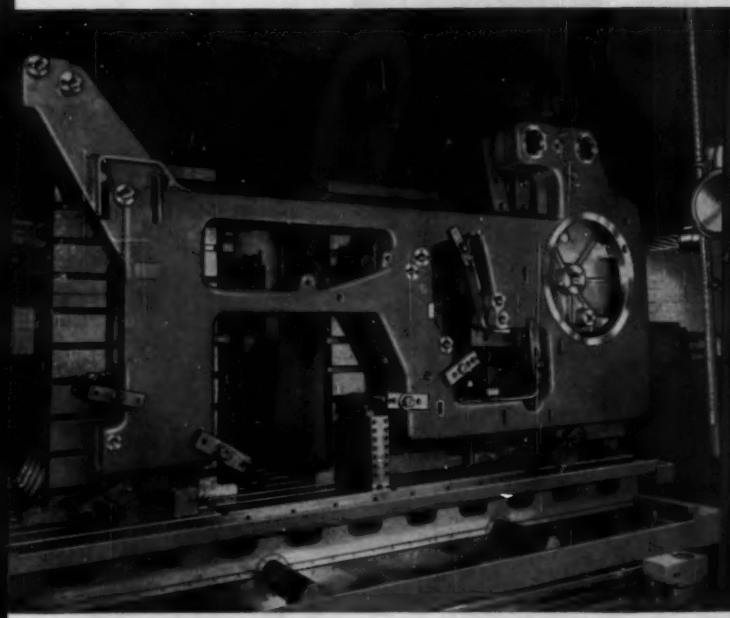
"We accepted an invitation to go to Fair Street and there saw the JIGMIL Technique in operation doing boring and milling to high degrees of accuracy and economy. The potential savings in our own plant became apparent and we developed a JIGMIL program which resulted in new economies in our manufacturing methods. The inherent accuracy, power and rigidity of this machine tool, combined with its automatic positioning and ease of operation are especially adaptable to precision boring and milling operations on side frames and gear boxes. In addition to the noteworthy savings in boring time and reduced tooling cost, we gained the advantage of milling in the same setting at a minimum of cost."

T. R. DREYER

DEVLIEG MACHINE COMPANY, 450 FAIR STREET, FERNDALE • DETROIT 20,

SOME OF OUR JIGMIL USERS

Aerojet-General Corp.
American Can Co.
Avco Manufacturing Corp.
Baldwin-Lima-Hamilton Corp.
Beech Aircraft Corp.
Boeing Airplane Co.
Boyar-Schultz Corp.
Carrier Corp.
Clark Equipment Co.
Continental Can Co., Inc.
Convair, A Division of General Dynamics Corp.
Crankshaft Machine Co.
The DeLaval Separator Co.
Detroit Broach Co.
Douglas Aircraft Co., Inc.
Eastman Kodak Co.
Emsco Manufacturing Co.
The Falk Corp.
Foote-Burt Co.
Goss Printing Press Co.
Grumann Aircraft Engineering Corp.
Hamilton Ltd., Division, United Aircraft Corp.
Hardinge Bros., Inc.
The Heil Co.
Illinois Tool Works
Ingersoll-Rand Co.
LeTourneau-Westinghouse Co.



A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE—

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

ACCURACY IS AN ECONOMY!

A TYPICAL EXAMPLE OF JIGMIL VERSATILITY

AMF uses the JIGMIL Technique for machining a multitude of components for their cigarette making machines, bread-wrapping machines, automatic pin setters, cigar making machines and many others. Illustrated is a pair of bread-wrapper side frames set against angle blocks on a Model 4B-96 SPIRAMATIC JIGMIL. All boring and side milling operations were done on the JIGMIL in one setup. Previous time on conventional boring and milling machines was 10 hours per part. Time on the JIGMIL is 3 hours per part.

The Glenn L. Martin Co.
Michigan Tool Co.
North American Aviation, Inc.
Northrop Aircraft, Inc.
Otis Elevator Co.
Pratt & Whitney Aircraft Division, United Aircraft Corp.
Solar Aircraft Co.
Speco Division, Kelsey-Hayes Co.
Thompson Products, Inc.
United Shoe Machinery Corp.
Western Electric Co., Inc.
Yale and Towne Manufacturing Co.
York Corp.

WILL YOU BE THE NEXT TO VISIT FAIR STREET

Model 4B-96 SPIRAMATIC JIGMIL as used by American Machine & Foundry Co.

For complete information on DeVlieg Spiramatic Jigmils, send for new catalog.

MICHIGAN

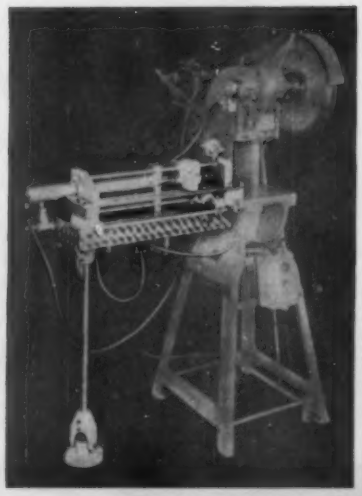
DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES IN PRECISE LOCATIONS

IMPROVE YOUR PRESS-ROOM PRODUCTION WITH THESE

U S PRODUCTS ★



Left: ASF-12 U. S. Air-Operated Slide Feed used in conjunction with small OBI Press. On light work requiring long pitch or feed length, this type of Feed can be used with presses much smaller than would ordinarily be required.

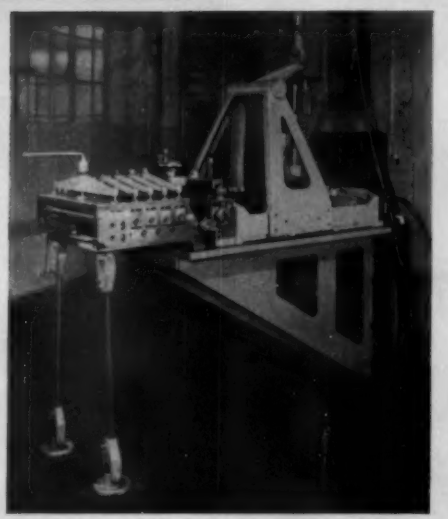
Gain all the advantages from the use of coil stock in your Press Room by arranging your presses with automatic equipment. The illustrations show just a few of the many units included in the line of U. S. Automatic Press Room Equipment designed and built to aid you to reduce costs and increase production. Every operation eliminated will increase your profit potential and place you in a more favorable position in today's competitive market.

Investigate! Ask for copies of Bulletins 80-A and 95-A.

U. S. TOOL COMPANY, INC.

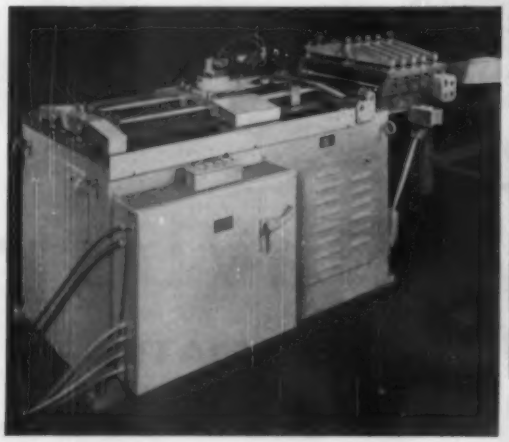
Ampere (East Orange) **New Jersey**

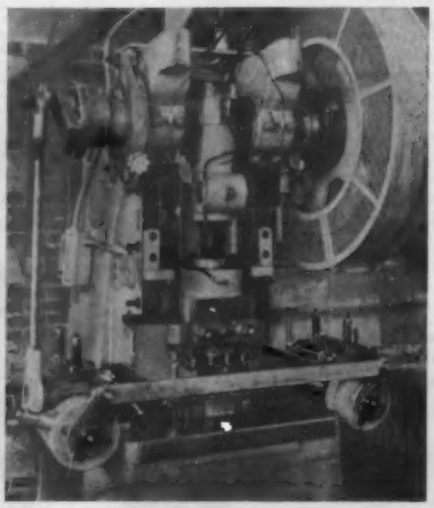
★ **U. S. PRODUCTS** — Slide Feeds — Roll Feeds — Plain and Power Driven Straighteners — Plain and Power Driven Stock Reels — Coil Cradles — Combination Cradles and Straighteners — Stock Oilers and Wipers — Scrap Choppers — Die Sets — Multi-Slides® — Multi-Millers®



Above: SF-24-24 U. S. Slide Feed equipped with Plain Straightener mounted on Straight Side Press. Capacity for material up to 24" in width, feed length adjustable up to 24" per stroke. Same type of Feed made in smaller sizes.

Below: SFC-24-24 U. S. Cabinet-Mounted Motor-Driven Slide Feed equipped with Plain Straightener. Capacity for material up to 24" in width, feed length adjustable up to 24" at one stroke. Equipped with counter to permit multiple stroking to obtain longer lengths.





Left: U. S. Double Roll Feed (push-pull type) mounted on conventional OBI Press. Direction of feed can be either right to left or left to right. Made in range of sizes.

THE MONARCH RIGHT ANGLE IS YOUR BEST ANGLE

. . . for the turning, boring, and facing of thin-walled work pieces having large diameter and short length.

Here's a specialized chucking machine for optimum output—for every plant producing this type of work in sufficient volume.

For instance: large metal gaskets—large refrigerator compressor discs—miscellaneous disc and ring work—specialized mold work—tire rings and mold shells for tire manufacturers—large diameter housings. And, of course, jet engine components such as discs, wheels, rings, spacers, vane assemblies, shrouds, and so on.

Specifically, you get such Monarch specialties as Air-Gage Tracer controls, completely automatic turning cycle with push button control, power angular feed, in-built constant surface cutting speed on the Model F (principally for facing), and dual slides on the Model O (principally for turning and boring).

Monarch Right Angle Lathe, Model O.
Swing in gap—60". Maximum turn diameter—48".
Maximum work width—12". Motor size—20 H.P.

All the features and uses of this machine would fill a book. They do, and we have it. Just ask for Booklet #1401 . . . . . **The Monarch Machine Tool Company, Sidney, Ohio.**

Monarch
TURNING MACHINES

ACCURACY • ECONOMY • LONG LIFE

FOR A GOOD TURN FASTER...TURN TO MONARCH

EXTRA CUTTING LIFE

You get more cuts per bit, more cuts per dollar when you use du Mont Tool Bits.

That's because du Mont steel has an extra fine grain structure, *precisely balanced* in *toughness*, in *wear resistance*, in *red hardness*.

duMont

TOOL BITS

High Speed Ground Square and Rectangular

Fill in the coupon below to get full information. Make your own performance tests and see what a difference *balance* can make.

MAIL TODAY—SAVE TOMORROW

The duMONT CORPORATION
Greenfield, Massachusetts

MAIL FREE Tool Bit COMPARISON CHART, CATALOG and PRICE LIST A to:

Name.....

Company.....

Address.....

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Conveyor Trends

Dear Sirs:
Here is the forecast you requested of the major trends in conveyors as they apply to automotive lines:

1. Greater stress on reliability will govern design of conveyor controls and equipment for fast operations. Higher first costs for improved design, possibly utilizing new materials, improved accessory components, heavier track sections, and new ideas will be permitted to offset costly production down time on fast lines.

2. As the crop of shortcomings for the first tremendous surge of automation ideas evidenced itself, designers have carried on an improvement program, fundamentally searching for a means of assuring continuance of production during breakdowns at individual stations. It appears that a system of automatically handling parts through an operational sequence, incorporating storage, inspection, and orientation facilities between operations, will open up a new series of applications for standard machine tools. Providing a measure of elasticity between machines will definitely help to reduce changeover costs and times.

3. In an effort to reduce handling costs, more and more conveyors will be incorporated into a synchronized system, which in turn will necessitate new and better electrical controls to effect the required coordination. Simplicity and reliability will be industry's demand.

4. Reduced operational budgets will force greater utilization of such service aids as chain degreasers and scrubbers, lubrication devices, slack chain devices, improved trolley, roller turn, and traction wheel bearings, high temperature lubricants, and torque safety cut-outs.

These trends are rather broad, and I believe conveyors will progress in these directions for the next five or ten years.

L Churgay, *Chief Plant Engineer*
Chrysler Corporation
Detroit, Mich

Mr Churgay's comments arrived too late to be included in our forecast issue of Metalworking in

SHOPMATES

N. Jarvis

—GONNA PUT THE SADDLE ON NOW?? OKAY—HAND IT RIGHT UP TO ME—WHOOPS—"SOKAY!!"—JUST AS SOON HELP YOU GUYS—I'M NOT DOIN' ANYTHING IMPORTANT
HE NEVER DID DO ANYTHING IMPORTANT—BUT IF HE COULD MANAGE TO FALL OFF AND BREAK HIS HEAD—THAT'D BE AN IMPORTANT EVENT—IN OUR FAVOR!!
HM YOU CAN'T HURT! HE WAS HELPIN' ME ONCE—HE STUCK HIS NOSE IN A SOCKET AND BLEW EVERY FUSE IN THE STATE!!
N. Jarvis

Designed to do one job in the best possible way.....

LELAND-GIFFORD *Special* DRILLING MACHINES

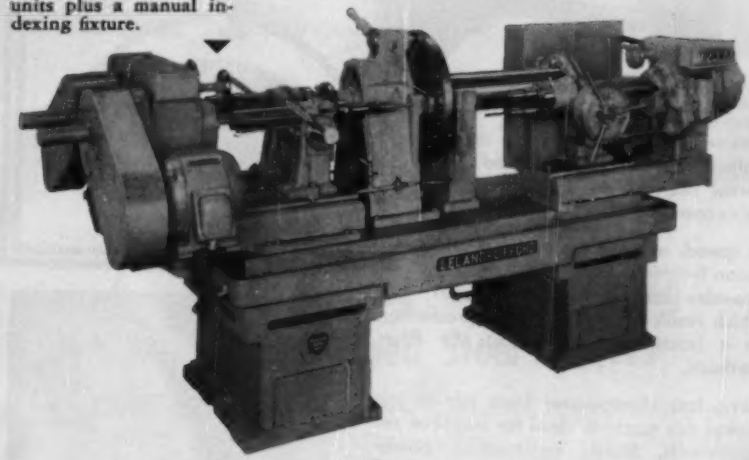
Contact the office nearest you for help with your drilling problems.

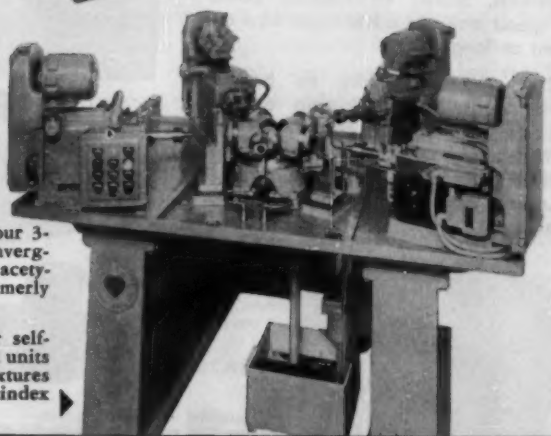
THE JOB — Drill two .630 x 3¾" x 25° holes in 4-cylinder and 6-cylinder crankcases.

THE SETUP — A No. 3 self-contained step feed unit with 2-spindle head, special base cabinet with roller-type fixture, plus angular top column. Ties into conveyor line to eliminate lifting.

THE JOB — Drill and ream 48 holes (tap and countersink 24) in an aircraft turbine shaft.

THE SETUP — Two single (left) and one 2-spindle (right) horizontal V-belt units plus a manual indexing fixture.





THE JOB — Drill four 3-diameter deep converging holes in copper acetylene torch tips. Formerly a hand operation.

THE SETUP — Four self-contained step feed units plus five holding fixtures and a hydraulic index table.

LELAND-GIFFORD
Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

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ROCHESTER 12, P. O. Box 24, Charlotte Station

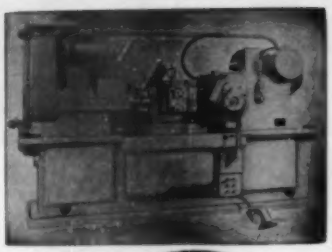
ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS and DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding achievement.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages also apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.



Illustrated literature available promptly on request. Send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

1962 (AM—Nov 18 '57), but we have included them here, because we believe they are too significant for our readers to miss—Ed.

Methods

Dear Sirs:
Please inform me how and at what cost I may obtain a copy of your Special Report No. 379 on "How to Work Steel."

I saw a copy of it recently, and I wish to comment that it is certainly a storehouse of knowledge in the field. I can make good use of it in my timestudy and methods work.

Clifton C Pyles
Dayton, Ohio

Copies of this Special Report are still available from our Reader Service Department at 50¢ per single copy—Ed.

Numerical control

Dear Sirs:
Mr Stocker has done an excellent job of presenting numerical control (*AM*—July 15 '57, p133), and I was pleased to notice that other articles were to follow in subsequent issues.

My position is with Purdue University as a teacher in the Machine Tool Laboratory. I follow machine tool applications very enthusiastically and expect to organize a unit of instruction dealing with numerical control.

Please send me a set of re-

Helpful Henry

by L. Hoppes

"It's all right, I'll put you back soon as I clean under there!"

prints concerning numerical control and advise me as to the charges.

G F Hartje
Lafayette, Ind

Numerical control has been discussed in three American Machinist *Special Reports so far: No. 377, "Numerical Control, what it means to Metalworking (Oct 25 '54); No. 446, "The Production Man's Guide to Numerical Control" (July 15 '57); and No. 452, "3 Steps from Print to Part" (Nov 4, '57).*

Reprints are available from our Reader Service Department at a charge of 35¢ for No. 377, 50¢ for No. 416, and 30¢ for No. 452—Ed.

CALENDAR

SOCIETY OF AUTOMOTIVE ENGINEERS — Annual Meeting and Display, Jan 13-17, Sheraton Cadillac and Statler Hotels, Detroit, Mich.

NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION — Winter Meeting, Feb, 5-8, Ambassador Hotel, Los Angeles, Calif.

AMERICAN MACHINE TOOL DISTRIBUTORS ASSOCIATION — Spring Meeting, Mar 10-11, Hotel Roosevelt, New Orleans, La.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS AND AMERICAN ROCKET SOCIETY — Joint Aviation Conference, Mar 17-20, Hotel Statler-Hilton, Dallas, Texas.

SOCIETY OF AUTOMOTIVE ENGINEERS—Production Meeting and Forum, Mar 31-Apr 2, The Drake, Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS—Aeronautic Meeting and Display, Apr 8-11, Hotel Commodore, New York, NY.

AMERICAN WELDING SOCIETY—Spring Meeting and Welding Show, Apr 14-18, Statler Hotel, St Louis, Mo.

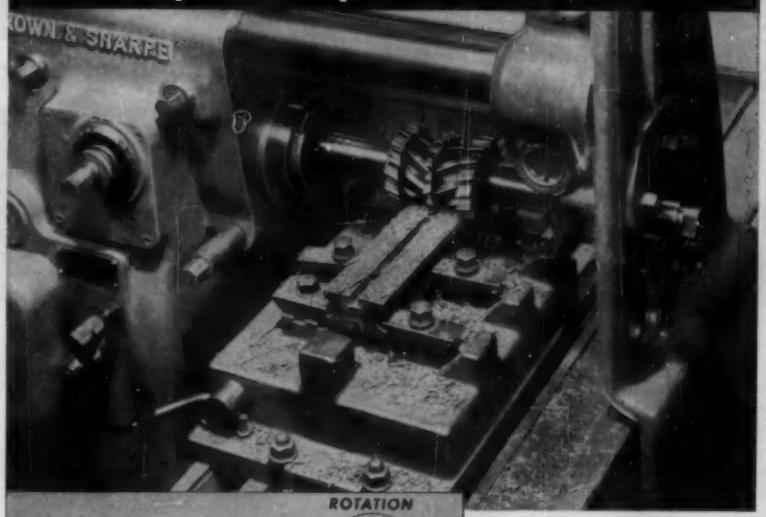
AMERICAN SOCIETY OF TOOL ENGINEERS—Tool Show, May 1-8 (closed Sunday), Convention Center, Philadelphia, Penna.

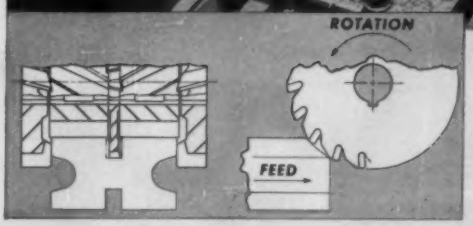
NATIONAL TOOL & DIE MANUFACTURERS ASSOCIATION — Spring Meeting, May 3-6, Statler Hotel, Washington, DC.

AMERICAN SOCIETY FOR METALS—Southwestern Metal Exposition and Congress, May 12-16, State Fair Park, Dallas, Texas.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Semi-Annual Meeting, June 15-19, Hotel Statler, Detroit, Mich.

Brown & Sharpe CHIPS Stock removal costs money!...Chips tell *how much*





In climb (down) milling, work is fed in direction of cutter rotation. Chip is thickest at initial engagement of tooth, reaches minimum thickness at point where tooth ends downward travel through workpiece.

Economical "Gang" Climb Milling with High Speed Steel Cutters

Smooth, continuous chips prove that these Brown & Sharpe plain milling cutters are "climb milling" with top efficiency. Climb milling is used where work piece is difficult to hold, and for greater cutter life when milling tough steels and alloys.
Climb milling should be done only with cutters having rigid, sharp teeth and precision ground cutting edges. Brown & Sharpe High Speed Steel Cutters are PRODUCTIONEERED for longer life at high speeds—no matter what type of milling is performed. Get the most out of your milling machines: Maximum speeds and feeds with less horsepower, less downtime. For real production economy, always specify Brown & Sharpe PRODUCTIONEERED Cutters!

Write for 80 page Brown & Sharpe Catalog showing over 2300 High Speed Steel Tools and Accessories.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Brown & Sharpe

BROWN & SHARPE MFG. CO. • PROVIDENCE 1, RHODE ISLAND

STOCK OF OVER 3000 STANDARD TOOLS!
Obtain impartial High Speed Steel, Carbide and Carbide Tipped tooling recommendations from your Brown & Sharpe-NELCO Distributor.

What is the BIGGEST

Here's LeBlond rigidity in action at Alliance Tool & Die Corp., Rochester, N. Y. The part is a 6500 lb. molybdenum steel compressor wheel. 32 micro finish and ± .001", minus .000" critical tolerance on bore, recess and hub!

workpiece your lathes can turn?

Probably your lathes will swing a 32″ piece. Or 40″. But what happens when that occasional 50″ or 60″ job comes along? Chances are you have to say, "We can't handle it. After all, how can you justify a big swing lathe, just for a few big jobs a year?"

Today there *is* a practical and economical solution to this odd-size work problem. LeBlond Sliding Bed Gap Lathes.

Our 32″/60″ Heavy Duty will accommodate work up to 60″ diameter! Basically this is a 32″ lathe. But it has an extendible bed (an upper bed that slides on a lower bed). Slide it to the right, and a gap opens. Now, you have a full 60″ swing! Also, for extra long work, there is 50% greater center distance. And the rest of the time you have a regular 32″ heavy duty lathe for a wide variety of work.

3 lathes in one—at the cost of a lathe and a half!

Here's an example of how this extra capacity pays off. Alliance Tool and Die Corp., Rochester, N. Y. are specialists in unusual machining problems, like precision molds—and the bulky compressor wheel, shown here. How did they turn it before? They didn't. The part was too big. Now, with their 32″/60″ LeBlond (recommended by Macaulay Machinery Co., Rochester, N. Y.,) they take jobs like this right in stride. Actually, this particular order was made possible by this lathe.

If you do job shop work, you can consider this lathe a business-getter. If you're doing your own maintenance, it gives you the capacity to do virtually all your own turning work. LeBlond Sliding Bed Gap Lathes are available in 4 sizes—16″/38″, 25″/50″ and 32″/60″ (shown) Heavy Duties and the 17″/28″ Regal. You're sure of getting the right lathe for your job when you buy LeBlond. There are 76 lathe models to choose from. Call your LeBlond Distributor or write.

Here's how the LeBlond Sliding Bed Gap Lathe gives you extra capacity for extra large work:

BED GAP CLOSED—*functions as a regular 32″ lathe.*

BED GAP OPEN—*full 60″ swing.*

BED FULLY EXTENDED—*50% greater center distance.*

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LEBLOND of Cincinnati

World's Largest Builder of a Complete Line of Lathes for More than 71 Years

LONG

processing time
is cut **SHORT** on the new

Electrically Controlled

KING

INTERDEPARTMENT MEMO
To – Scheduling
From – Expediting

OK to re-route #23.
Bob gets all his jobs
through faster now
with that new King
Pete

Whether you set up on a long production run or a single "maintenance" job, you can *finish it better, faster, and at lower cost* on an all-new KING® Electrically Controlled Vertical Boring and Turning Machine.

. . . because the new KING has *Full Electrical Control* — with all controls conveniently located:

☆ ***YOU CUT CONTROL MANIPULATION TO A BARE MINIMUM AND SPEED SET-UP TIME.***

. . . because the new KING is *Powered for Productivity* — 40 and 50 H.P. on 30", 36", and 46" sizes; 75 and 100 H.P. on sizes 56" and up:

☆ ***YOU CAN OPERATE THE MOST ADVANCED MODERN CUTTING TOOLS TO THEIR FULLEST CAPABILITIES.***

. . . because the new KING has *Expanded Feed and Speed Ranges* — 24 pre-selective feeds from .0016 to .250 per revolution . . . 24 pre-selective speeds in any one of three standard ranges:

☆ ***YOU GET REQUIRED FINISH AND SPECIFIED TOLERANCES ALL THROUGH THE SET-UP.***

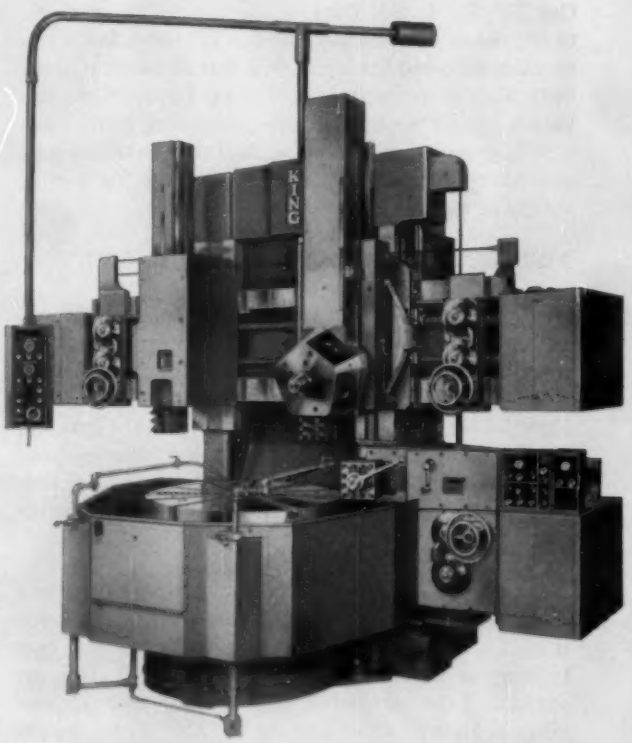
. . . because the new KING has an outstandingly improved spindle and spindle mounting:

☆ ***YOU GET MAXIMUM TABLE STABILITY WITH RESULTANT INCREASED AND UNIFORMLY MAINTAINED ACCURACY.***

. . . because the new KING is readily adaptable for addition of Optional Features such as *Automatic Cycling, Automatic Feed Stops, Automatic Tracing Control of Heads, Power Indexing of Turrets, etc.*:

☆ ***YOU HAVE BROADER TOOLING VERSATILITY FOR ATTAINING EXTRA-FAST AUTOMATED PRODUCTION AT MINIMUM COST.***

For complete details on Electrically Controlled KING Machines see the KING Distributor in your area or write us direct.



Machine illustrated is a 46" size with Ram Head and Turret Head on Rail, Side Head, and Complete–Unit Coolant Pan. Electrically Controlled King Machines are available in sizes 30", 36", 46", 56" and up, in a wide variety of head combinations, with or without side head.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

Spot news...

- **Government is competing unfairly with private chem-milling plants,** which are operating at less than 40% of capacity, by furnishing such facilities rent-free to several major defense plants, the Strategic Industries Association, an organization of small subcontractors, charges.
- **Russia could equal America's auto output "in the twinkling of an eye"** if it wanted to, Pierre Dreyfuss, head of France's giant Renault Automobile Co, claims. Sputnik launchings, he says, prove "without a doubt that the USSR has taken first place in the fields of metallurgy, chemistry and automation." Only reason Russian auto output is low today, he adds, is that Russia has concentrated on space travel and electronics instead.
- **Rash of small strikes** is designed to keep automakers from building enough inventory to withstand a prolonged industry-wide UAW strike later on, according to one theory that's getting widespread attention in Washingon. UAW strikes so far: GM Transmission, Plymouth Engine, Ford Louisville.
- **Oregon legislators are going all-out to bring in new industries.** The bait: an 18% average cut in personal income taxes, cancellation of property taxes, no sales tax, and writing into Oregon law the federal tax law's provision for loss carryover and accelerated depreciation.
- **Rocket and missile production problem:** to be able to meet the extra-fine tolerences required for certain components. Shortage exists of production equipment, and measuring instruments, not to mention trained personnel to do the job.
- **Reuther is afraid Senator McClellan will foul up his bargaining moves** this spring by fixing a date on the three-year-old UAW-Kohler Co strike to coincide with auto industry wage negotiations—and while UAW feels it has a good case, it's afraid of an unfavorable press at a crucial time.
- **Antitrust action against Volkswagen of America Inc** and its 14 wholesale distributors is being undertaken by the Justice Dept on grounds that Volkswagen and its dealers have conspired to fix prices, allocate exclusive US sales territories, to limit sale of parts to other retailers, and 300 dealers have agreed not to handle other foreign cars or parts.
- **Canada's shilly-shallying over auto excise tax cuts has hit car demand hard.** Canadian public isn't buying until the anticipated tax slash savings shows up on price tags. Consequently some 16,400 auto workers have been laid off by GM Chrysler and Ford of Canada pending a firm decision.
- **Federal study of automation's effect upon workers never got off the ground.** Proposed by Michigan's Republican Senator Potter last August, the study bogged down when Labor Dept revealed it has no money or men to do the job.
- **Maine will guarantee 90% of a maximum $1 million loan to incoming industry,** with interest charges pegged at 6%. But loan must be applied for by local civic groups. Best Maine Metalworking potential: electronics.
- **Japan will clean its own house on the pirating of designs** from other nations by strengthening existing laws in response to complaints from manufacturers of many countries. Its provisions: only original designs can be copyrighted; copies of designs appearing in foreign publications will be barred; violators must pay compensation and refund all profits to the originator.

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Precision Threads Roughed And Finished

Automatically!

Automobile steering gear ball-race screws in three stages of processing: blanks, rough-ground, and finish-ground.

Ex-Cell-O Style 33 Thread Grinder equipped to automatically grind steering gear ball-race screws.

XLO EX-CELL-O FOR PRECISION

These automobile steering gear ball-race screws are rough-ground from the solid on an Ex-Cell-O Thread Grinder. This operation was formerly done by thread hobbing or milling. The screws then go into the machine illustrated, an Ex-Cell-O Style 33 Thread Grinder, equipped for automation. It self-loads, locates, finish-grinds, and ejects steering gear screws. What's more, when desired, the wheel can be automatically dressed after completing a predetermined production. It increases hourly per-unit output over manually operated machines while actually decreasing the number of rejects. A double saving.

Ex-Cell-O Precision Thread Grinders come in a wide range of models—some best suited for toolrooms and short runs, others designed for fully automatic, high volume output. In all, there are five models adaptable to any production requirement.

Why not find out today how these Ex-Cell-O Precision Thread Grinders may be able to reduce your per-unit costs? For full information, just call your nearby Ex-Cell-O Representative.

EX-CELL-O CORPORATION *Machinery Division*

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Washington ... NEWS REPORT

McElroy is a bigger man ...

. . . on defense spending as a result of the confusion following Eisenhower's illness. Even as Eisenhower was coming back to the White House to work after only a few days of rest, the record seemed clear: McElroy will make his showing at the Pentagon on the side of bigger spending, not cutting back orders.

The White House is now cut loose from its hard-and-fast ceiling on military spending, but the Democrats in Congress are dissatisfied with what the administration has done and proposes to do. This makes it easier for McElroy—already in unmistakable charge of things at the Pentagon—to throw his weight to bigger programs for new military hardware. But the other side of this is that he'll also press to make some savings through cutbacks on purchases of conventional weapons—manned aircraft, ships, and the like.

The budget that goes to Congress next month should spell all this out. But there's an expectation that the document won't give the real details on the administration's spending plans for fiscal year 1959.

Some figures on hardware spending will be lower than they should be; spending on missiles and new weaponry is also likely to be understated. Reason: cutback on conventional weapons can't be made as deep and as quickly as the administration would like; spending on missile and other new programs will probably go up faster than anticipated.

Transportation costs ...

. . . are going to go up next year. Railroads are getting set to ask the Interstate Commerce Commission for a new round of rate boosts estimated to cost shippers an additional $200 million a year. You can count on truckers and waterway carriers to follow suit. Not all this increase will be granted, but some of it is sure. It will come on top of nearly $1 billion in freight increases the ICC has allowed the railroads already this year. The new increase won't be across the board percentage hikes; mostly, it will come in increases on particular commodities and classes of items.

No wage increases ...

. . . for his members was proposed by a big AFL-CIO union leader at the big labor get-together in Atlantic City. The head of the Building Trades Department, Dick Gray, suggested that his unions forego asking wage increases in order to fight inflation during the year ahead.

Gray suggested that unions in such industries as steel, lumber, cement, and the like join in a wage increase moratorium. But the outlook is for the metalworking unions—led by Reuther and his Auto Workers—to go out for increases even larger than this year.

No other union leader is going to join Gray, and not many of the building trades are likely to join up in any such crusade. AFL-CIO chief George Meany immediately came out against it.

Reciprocal trade outlook ...

. . . isn't nearly as bright as the administration would like it to be. Nixon and other administration spokesmen have been plugging for a five-year extension of the Basic Trade Agreements Act, which expires next year. Hearings have already been held by a House Ways and Means subcommittee.

The administration hopes to make extension of reciprocal trade an essential to refurbishing our ties with our allies. The hope is that Congress will be more receptive, since presumably anyone can see that the new Russian threat makes our allies more important to us.

However, protectionist sentiment seems stronger than ever. Southern legislators hold the key spots in House and Senate—and as the South has industrialized, they're no longer the solid bloc in favor of building foreign trade.

The guessing is that a new law will be passed, but it will carry new restrictions on the President's authority to negotiate lower tariff rates.

Your income tax ...

. . . form this year needn't be any more detailed on your expense account than it was last time around, if your expense account situation is about the same as it was last year. That's the wind-up of a whole flurry of confusion that began when the Internal Revenue Service put a new line in the form for 1957 income tax, which seemed to require detailed accounting of every dollar spent by you for your employer's account.

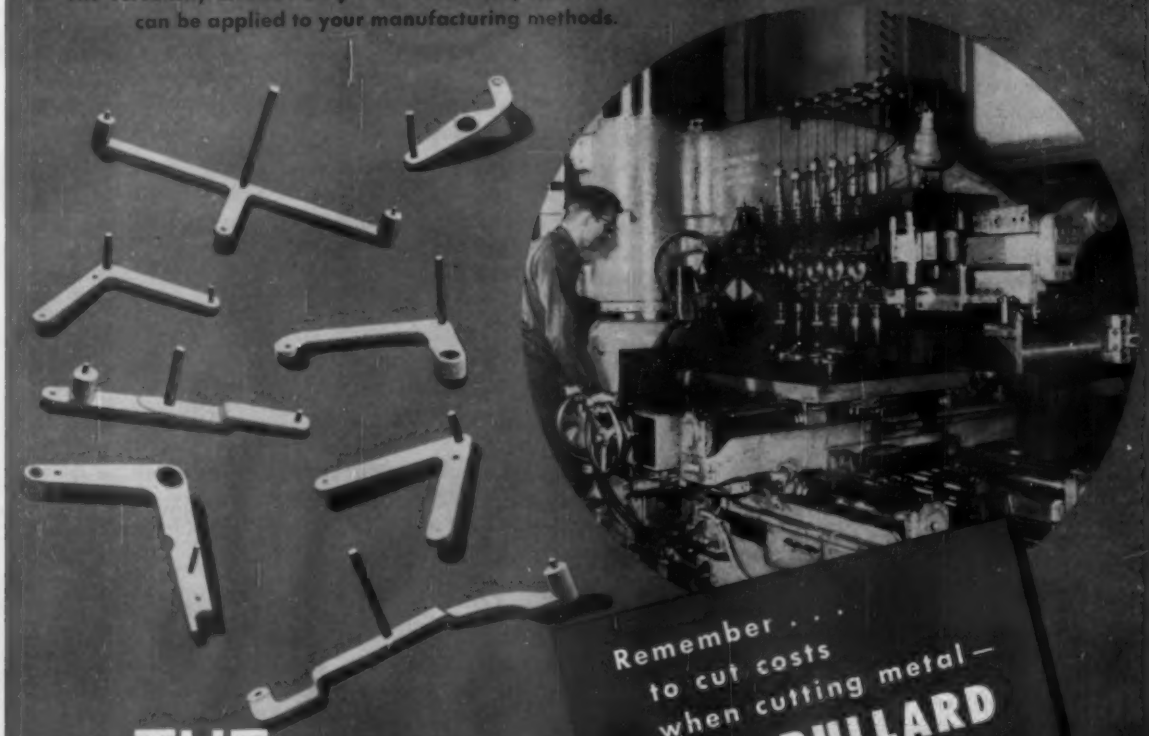
Last word is: forget about the new line, unless you've always been filing explanatory information—as the big expense account spenders have had to do under long-standing regulations.

CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

. . . AN 8 TO ONE SAVING WITH

BULLARD Spacer Table

is obtained by the Daystrom Instrument, Division of Daystrom Incorporated, Archbald, Pa., on drilling and boring various sized holes with diameter tolerances of ±.0002 and center distances of ±.0005. The major part of this saving is due to eliminating the necessity of making costly drill jigs and boring fixtures for each individual piece or operation. The multiple drill head, with variable speed drive, at Daystrom Instrument, is set up to drill and bore three different diameters on as many as fourteen holes in one set-up. The versatility and accuracy of the Bullard Spacer Table can be applied to your manufacturing methods.



Remember . . . to cut costs when cutting metal— buy BULLARD

THE BULLARD COMPANY

BRIDGEPORT 9, CONNECTICUT

Detroit . . .

Who's got the vitamins? . . .

The Edsel spokesman glowered: "Sales are what we expected but not what we hoped. We're gearing our operations to actuality."

He was explaining why Edsel production has dropped to 350 units weekly, a rate more than 10 times under that necessary to achieve the ambitious pre-announcement goal of 250,000 cars for the first model year.

About 55,000 Edsels have been built since production started last July 15. A peak was reached the last week in August with 5600 assemblies. The latest tabulation shows 15,873 Edsels registered through October. All signs indicate that the November total will be less than 6000 cars.

This means that there are about 30,000 cars in the hands of only 1167 dealers—a heavy inventory when compared to the all-make average of 13.5 cars per dealer.

Dealers are loyal . . .

The situation is serious but no one has panicked. Despite wide publicity given to a few mavericks, dealer turnover is negligible. Edsel division has launched an unprecedented direct mail campaign (1.5-million letters) aimed at owners of competitive medium-price makes. The object is to get people to try an Edsel in the belief that the car will then sell itself.

Advertising themes have switched from institutional to out-and-out price plugging, emphasizing the fact that bottom-line Rangers are cheaper than competition. Factory business management teams are circulating among dealerships, helping to solve problems that could be only guessed at before the car was on sale.

Edsel's big problem is no heritage of owners. Every sale is a conquest. This problem, of course, has been faced by all new makes. Back in 1939, Mercury captured only 1.15% of industry sales for its first month. DeSoto in 1929 achieved a relatively miserable 0.46%. Edsel so far accounts for 1.2%. In a recent closed-circuit TV speech to Edsel dealers, Henry Ford II underscored that there will be a heritage, however small, initially. He said: "We are firmly committed. The Edsel is here to stay."

Pre-battle diplomacy . . .

"Verbal brickbats exchanged between business and labor leaders can be safely ignored—they aren't really headed your way," says University of Michigan's Meyer Ryder, professor and noted labor arbitrator.

In general, he said, most collective bargaining passes through six stages:

- **"Probing"**—A general feeling out of the battle lines.
- **"Dressing"**—Appeals to the public, actually aimed at softening up the opposing lines.
- **The "simulated real" positions:** Initial concessions in demands and counteroffers.
- **The "real position":** Actual limits to which each side is prepared to go.
- **The "trade position:** Concessions made around the "real" position.
- **The "take" position:** The final contract that emerges after all the skirmishing.

A strike may appear to disrupt this process, but in most cases Ryder notes, "With a strike in being, pressure toward a settlement accelerates the tempo with which both parties move from simulated to real to take positions."

UAW-CIO is still "dressing." The scheduled Kefauver Committee hearings on auto prices have been postponed by mutual agreement of the Senator, Big Three auto company presidents, and Walter Reuther until January 23. American Motors President George Romney, previously ignored, has succeeded in wrangling an invitation to the hearings.

Reuther approves the delay because it gives him the chance to obtain rank & file endorsement of his stand prior to appearance before the Committee. The union's Constitutional Convention is scheduled for January 21-24 in Detroit. The real reason, however, was purely political. Senator Johnson's "Sputnik" committee, meeting in December, would have stolen Senator Kefauver's thunder.

The long way around . . .

Meanwhile, the UAW must have time hanging heavy on its hands, judging by the following bit of circumlocution:

UAW VP Pat Greenhouse wrote J I Case Co President John T Brown that the firm must bring its wage and employee benefit levels up to the standards enjoyed by workers in the rest of the farm implement industry.

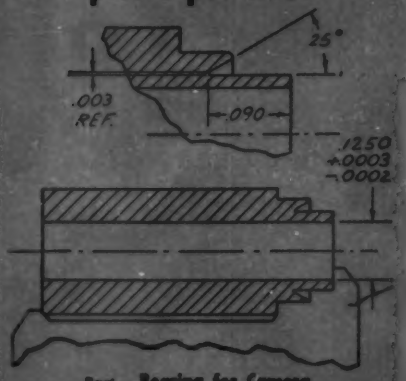
He went on to say: "Failure on the part of the company to grant these benfits will result in a situation which will make it impossible for the company to produce the number and kind of products necessary for it to compete successfully in the industry and bring a return on investment to its stockholders." The sentence can be translated in one word—strike.

at EASTMAN KODAK

33% HIGHER PRODUCTION

with new-design Brown & Sharpe Automatics

Production up from 257 to 342 pieces per hour



Part — Bearing for Camera
Material — 9/32" dia. Brass

OLD DESIGN No. 00G		NEW DESIGN No. 00
6000	Cutting RPM	7200
14	Sec. per piece	10½
257	Pieces per hour	342

There is no better "proving ground" for automatic screw machines than Eastman Kodak. An endless volume and variety of precision parts are required for their big production of cameras and other photographic equipment. To meet this demand at the lowest cost, Kodak takes full advantage of up to 33% gain in their production, plus the additional increase in overall efficiency delivered by the new-design B&S No. 00 Automatics.

The production figures listed, for a movie camera bearing, are a good example of the savings realized on many jobs. The higher speed of the new No. 00 permits an increase to 7200 in cutting RPM from the previous 6000. Tolerances as close as .0005" are easily maintained. Because of the improved deep drilling efficiency, drilling time is 15% less, with longer drill life. The saving in time per piece is 3½ seconds.

Figure the comparable savings you can make, in your operations, with the extra speed, precision, adaptability,—the easier set-ups and extended tool life you get with new-design B&S Automatics. You'll see why so many buyers say, "They pay for themselves, in record time." For complete details, write: Brown & Sharpe Mfg. Co., Providence, R. I.

B&S **Brown & Sharpe**

The home of PRECISION CENTER

MILLING, GRINDING, AND SCREW MACHINES
CUTTERS • MACHINE TOOL ACCESSORIES
PRECISION TOOLS • PUMPS

NEWS REPORT

Aircraft and Missiles...

Subs blast government competition...

Another blast at use of government-owned facilities for subcontracting has just been loosed by the Strategic Industries Association, most vocal battler for the small defense contractor. In a 40-page report, SIA says that if the government doesn't cut it out, there'll be no broad base of small, skilled firms for the country to fall back on in the event of a national emergency.

Says SIA "Government facilities are still being built for jobs that can be accomplished in existing facilities of subcontractors."

Primes, SIA claims, are not only using government-owned equipment to do work they formerly would have contracted out, they're competing for subcontracts they wouldn't have otherwise touched. One large West Coast prime reportedly has been preparing 400 to 500 subcontract bids a month, will use US-owned facilities to do the work.

SIA blames government policy more than the primes, who are doing what comes naturally under the circumstances. One of SIA's major targets is the government policy of allowing primes three and four times as much profit on in-plant work as on work subcontracted out.

In a suggested eight point program, SIA asks:

- That the Renegotiation Act be amended to specify "proportionately higher profits" for primes who demonstrate savings effected by subcontract procurement.
- That the Defense Dept prohibit use of government-owned machines or facilities for subcontract purposes without clear evidence that privately financed facilities aren't available to do the work economically.
- That when government-owned facilities are authorized for work on subcontracts, rental rates comparable to the cost of private operation be charged.

Otherwise, SIA charges, "unless the government does more than utter pious sentiments, the mobilization base of independent defense suppliers will be destroyed." Already, California subcontractors alone have dropped 40,000 from their payrolls since March.

Congress to probe air defense . . .

Look for a complete review of US defense policies early next month when the House Armed Services Committee gets into the act. The House committee covers a broader scope in its investigations than the Senate Preparedness Subcommittee's current look at the US missile program (see p154)—going into such diverse military activities as SAC base dispersal, service roles and missions, and military personnel problems —plus missiles.

Anti-missile missile stepup . . .

One military program slated for a shot in the arm is development of an anti-missile missile.

Two major anti-ICBM projects are already under way: Convair RCA's "Wizard" for the Air Force, and Douglas Aircraft-Bell Telephone Lab's "Nike Zeus" for the Army.

In addition, Sylvania Electric is developing the "Plato" for the Army. It's a battlefield defense system against such short-range ballistic missiles as our own Redstone.

Pentagon says the program is in an "early investigatory stage," and there are serious limits as to how such a program can be accelerated. A recent Pentagon memo to the President sums it up this way:

"Not enough is known in (the anti-ICBM) field generally to move forward on a large scale at this time . . . Some preliminary findings have already been made available to the Defense Dept, but it should be recognized that an anti-ICBM system would have to be integrated with systems for detection, tracking and destruction of hostile aircraft and aerodynamic missiles.

"The ultimate costs that would be involved are enormous, and premature decisions in this area could have extremely costly and could delay, rather than accelerate, real progress in this important field."

Missile workforce increases . . .

First evidence we've seen that the government's increase in missile output is getting down to tangibles is GE's recent announcement that it is increasing its 3000-workforce missile and ordnance departments at Philadelphia by 10%.

Overtime operations will be doubled to meet expanded missile requirements, too.

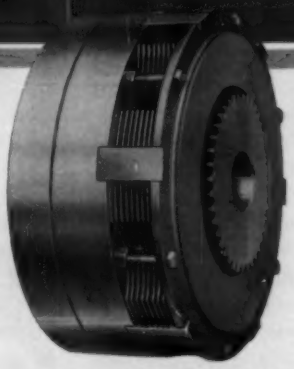
GE Philadelphia is currently working on a $150 million contract to develop equipment for the ICBM Atlas and the IRBM Thor.

Work on the Thor, incidentally, means a stepup in existing production, not a whole new program. At least six production-produced Thors have already been test fired.

Douglas, the prime for the Thor, says it already has the facilities for mass production, and GE and the other top Thor subs have, too.

FAWICK MAGNETIC— built to perform better

CLUTCHES & BRAKES



COIL — Vacuum molded construction using thermo-setting epoxy resin offers complete, bubble-free impregnation; excellent dielectric strength; resistance to shock and vibration; and high thermal conductivity which reduces temperature gradient and eliminates hot-spots.

MAGNETIC FLUX BARRIER — Brass construction provides maximum flux flow through armature-outer field ring circuit producing maximum effective torque.

SEPARATOR SPRINGS — Made of high-grade spring steel for quick release when coil is de-energized to assure positive separation of driving and friction discs.

ANTI-FRICTION BEARINGS — Special design assures accurate, consistent alignment of stationary and rotating members; negligible torque transmission to stationary member; and long life.

ARMATURE

CLUTCH BODY — Use of iron with excellent magnetic properties provides optimum torque characteristics.

FRICTION DISCS — Sintered metal fused on steel discs and grooved friction surfaces insure long life, consistent characteristics and efficient operation in oil or dry. Accurate standard AGMA stub involute internal gear teeth produce effective transmission of power.

PRESSURE PLATE — Accurately machined flat from steel to assure equal pressure distribution on friction discs.

DRIVE GEAR

Fawick Magnetic Clutches & Brakes are easily adapted for use in all machine tools and automatic machinery. They are produced in sizes from 2 to 13 inches diameter with torque ratings from 36 in.-lbs. to 48,000 in.-lbs. Standard operating voltage: 90 volts d.c. Other voltages available on request. Write for Bulletin M-101 or contact your nearest FAWICK Representative.

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FAWICK Magnetic
INDUSTRIAL CLUTCHES AND BRAKES

Machine tools ... NEWS REPORT

Large volume of inquiries reported...

The large volume of inquiries is the most hopeful factor for machine tool builders.

"We continue to receive many inquiries despite the dearth of actual orders placed," a prominent builder says. Another company states that it never has had so many quotations out as now. It feels that it can convert a good portion into orders before long.

Wide interest in programming . . .

Programmed machines are arousing interest among metalworking plants outside the aircraft industry. Certain builders accordingly are working on the programming of machines smaller than the giants used in aircraft work. One builder in particular expects to quote on and make these machines sometime during 1958.

Even contract tool and die shops are prospects for precision machine tools equipped with programming. One eastern shop has recently invested $50,000 in such a machine and already finds that it pays off handsomely.

New model pays off . ..

This is the time when developmental expense of new machines is paying off for some builders.

One midwest company reports that its new "baby" machine, which is used in machining small intricate parts in the business-machine industry, is in very good demand.

All builders do not report business off. A maker of general-purpose machines says that both October and November sales have been good and the outlook is optimistic for the first half of 1958. This builder put his shop on a 40-hr week October 1 and already some departments are back to 45 hr.

When asked how he accounts for his brisk volume of business, he replied, "It's probably due to the fact that we are not married to Detroit."

Missile retooling not near . . .

Don't look for retooling for missiles to cause much of a flurry in machine tool buying for some time ahead, West Coast distributors privately report. Most distributors won't even venture a guess at this point as to when such buying may occur, pointing to the fact that the whole program is dependent upon Washington decisions.

Such retooling may come within five months, the most optimistic distributor believes.

Another distributor feels that purchases for this purpose may be made in 1958, with big machines requiring long lead time being ordered. That would mean that deliveries would not be made until 1959.

West coast machine tool sales, which have been booming the past few years, have declined sharply since midyear and in general have been no better than the national average.

Schools to be offered surplus tools?...

A plan is afoot whereby every school and college will be able to secure government surplus machine tools for training purposes.

The machine tools would be given to educational institutions, not loaned to them. A provision would be made, however, for the government to retrieve them in case of an emergency. At the time of Korea, for instance, the armed services recovered large numbers of tools that had been donated to the nation's schools.

No new legislation would be necessary to carry out this plan. It could be done under the Defense Production Act; and the Office of Defense Mobilization could issue an order putting it into effect.

If one of the service departments should declare a machine tool to be surplus and another service department should want it, the latter probably would have first claim to it. But a movement is on to see that schools get an equal standing with other government agencies in asking for the surplus machine. In fact, some people would like to see the schools have priority.

The plan for turning over surplus machines to educational institutions has the full support of the Metalworking Equipment Division of the Business and Defense Services Administration, Department of Commerce.

Backing for the plan is sought of the Department of Health, Education and Welfare.

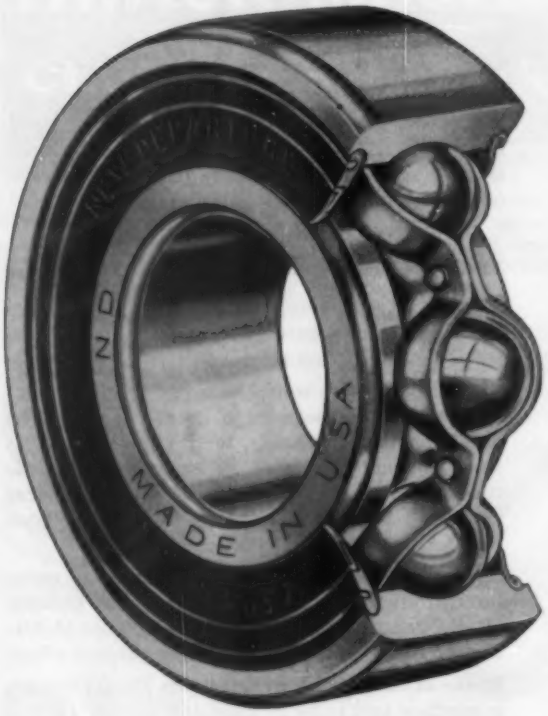
Surplus machines to be sold . . .

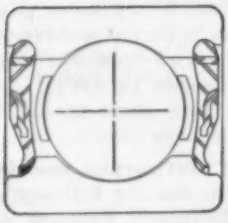
Department of Defense probably will put up for sale some 500 or more surplus machine tools early in 1958. But many of these tools are so specialized or so old that they will not constitute a serious threat to the new machine tool market.

It now appears that several thousand surplus machines will be sold by the government during the coming year. Washington officials are inclined to the belief that the number will not be sufficiently large to create much of a problem.

BF

ND FACTS





The diagram shows in section the New Departure Sentri-Seal. Lip-contacting surfaces are form-ground simultaneously with the ball race, giving an extremely high degree of concentricity between sealing surfaces and the raceway.

SENTRI-SEAL

on guard against dirt and wear!

The unique design of the Sentri-Seal gives optimum protection against dirt, and includes a number of other major advantages.

Sentri-Seals can be removed, easily replaced. As the seal is of synthetic rubber in which two metal rings are embedded, a constant-rate spring is created between the rings. Inherent flexibility prevents distortion of the bearing outer ring due to seal insertion, permitting the use of bearings to the higher accuracy specifications. The spring action maintains an efficient sealing contact with the bearing ring to bar dirt and retain lubricant. Sentri-Seals are relatively inert to oils and greases and operate satisfactorily through a temperature range of −40°F. to 225°F. Specifications available for still higher temperatures. In applications where relubrication is desired, it is easily accomplished by the injection method.

Write for full details on Sentri-Seal

1908–1958
GM
FORWARD FROM FIFTY

Sentri-Seal is available for a range of sizes in single-row, standard-width bearings and also in two types of New Departure adapter bearings. Sizes, dimensions and capacities are listed in the latest New Departure catalog.

ND NEW DEPARTURE
DIVISION OF GENERAL MOTORS, BRISTOL, CONN.
NOTHING ROLLS LIKE A BALL

What's ahead ... in Metalworking

NEWS REPORT

Metalworking will hold to present levels through first quarter...

Market for steel will remain "dull" through at least the first quarter of 1958.

Principal reason for this is the general reduction in steel inventories by automotive companies, who are today buying for a short term on fast deliveries—virtually hand to mouth—maintaining inventories of three weeks to 30 days.

Automakers' sheet steel inventories today are lower than they were in 1954.

That means that the mills cannot maintain their current rates of production, which vary by area from 71% to 95% of rated ingot capacity . . . and further layoffs are a probability.

All types and grades of steel, with the exception of heavy plate and heavy alloy steels in scattered areas, will be available in first quarter 1958. Inventories of sheet and strip have been cut to a point where manufacturers' orders in the near future will be more closely tied in with requirements than at any time in recent months.

Automotive parts outlook uncertain

Like the steel people, the makers of auto parts can't see any business upswing before second quarter 1958, although auto production may receive artificial support of a sort if the automakers begin to stockpile in anticipation of a prolonged strike when UAW comes to the bargaining table.

But automotive sales have been declining, after a brief upsurge, since mid-November. If this continues, automakers won't have to raise production levels much to add to strike inventories.

Uncertain, too, is the outlook for the aircraft parts business. Production schedules today are considerably lower than they were at the beginning of this year, and until the government comes through with definite information on who is going to make what and who will suffer further cutbacks or stretchouts, the parts makers aren't making any predictions about next year's business.

Steel castings industry, which is tied in heavily with both aircraft and automotive, is currently operating at 60% of capacity, and can't see much change before third quarter '58.

Appliance manufacturers aren't looking forward to much change in their sales picture before the second half of next year—although most of them do hope first quarter sales will be a bit better than those of this year.

Makers of farm machinery, who previously had anticipated a big business pickup—based on the fact that farmers can't go on forever with aging equipment—aren't so sure that pickup will materialize now. One reason is that dealers are heavily stocked—having laid in inventories in the third quarter in anticipation of a price increase in all lines of farm equipment.

Contract stamping shops, as might be expected of a metalworking segment that leans heavily upon automotive, aircraft and appliance orders, report that business has fallen "to much lower levels than are normal for this normally slow season," and most of them don't expect a pickup through the first quarter at least. There is much evidence of price cutting, too.

170

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

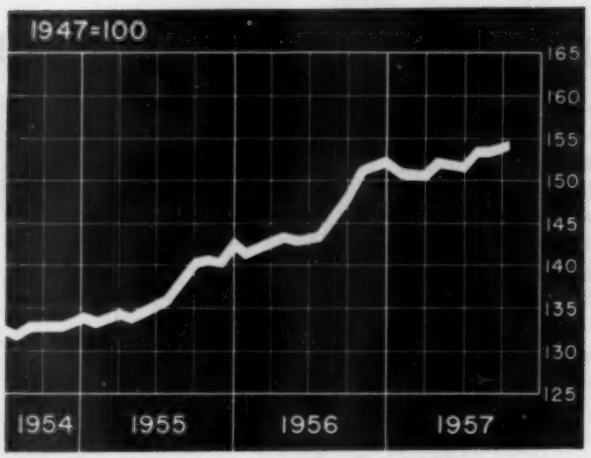
	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**170**	**170**	**174**	**177**
Machinery	**146**	**151**	**156**	
Electrical Machinery	**195**	**207**	**218**	
Autos	**114**	**94**	**113**	
Other Transportation	**362**	**399**	**355**	
Other Metalworking	**142**	**146**	**150**	

NEWS REPORT

What's ahead: . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**154.7**	**154.5**	**153.9**	**149.1**
Metalworking Machinery	182.3	180.4		172.4
Other Machinery exc. Electrical	164.0	163.6		157.3
Electrical Machinery	156.9	157.0		149.1
Fabricated Metal Products	144.5	144.5		141.4



Personal income declines, but the public still buys...

For the first time in several years, U S personal income is dropping. Between August and October, for example, personal income fell from an annual rate of $346.8 billion to $345.6 billion. In recent years, a drop of more than $1 billion in such a short time has been recorded only in case of a prolonged major strike.

Most of the decline can be attributed to layoffs and cutbacks in the automotive and aircraft industries—cutbacks which seeped down through layer upon layer of subcontractors and suppliers to affect thousands of worker incomes.

Just how long it will take for the personal income curve to turn up again is anybody's guess.

Automotive sales did show a belated upsurge as the new '58 models caught on with the public, then leveled off again.

But the aircraft industry, on the other hand, has to date shown almost no signs of recuperation from the severe setbacks it suffered a few months ago from defense contract cancellations and the long-term switchover in military aircraft from manned planes to guided missiles—this in spite of a gradual loosening of U S defense pursestrings occasioned by Sputnik.

But the public is stil in a buying mood. Installment buying—most of it for new cars, appliances and home improvement—continues to rise.

And the department store and retail tradespeople expect Christmas sales to zoom to all-time highs, although that could well be too optimistic.

Home buying is on the rise, too, with latest building contract figures showing an 11% rise over comparable 1956. So is non-residential building.

Highway contractors and makers of road-building machinery will get a much-needed shot in the arm from the government's recent commitment of more than $3 billion for federal highway aid.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	138.0	140.3	152.2
Steel ingot production (thousand tons)	1,843	1,846	2,493
Electric power output (million Kilowatt hours)	11,613	12,136	12,075
Production of automobiles and trucks	146,701	184,365	196,571
Engineering construction awards (Eng. News-Record, millions)	$201.0	$378.7	$323.3

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	229	302	298
Vacuum cleaners sales (thousands of units)	241	218	277
Washers sales (thousands of units)	329	335	364
Household electric ranges sales (thousands of units)	53	51	85
Radio production (thousands of units)	969	613	991
Television production (thousands of units)	674	361	613
Gear sales index (1947-49=100)	225.8	211.4	219.5
Foundry equipment new orders index (shipments, 1947-49=100)	231.3	98.6	188.3

* Seasonally adjusted

Which one?

The right choice is a call to Ryerson

You can be sure you're getting the right tubing for the job—with the services of a Ryerson tubing specialist as close as your telephone.

This man knows tubing—and tubing applications. He knows what will work and why. In many cases, he can recommend a type that will do a better job for you—perhaps a newer type that will save you money, either in first cost or in the cost of using it.

What's more, he offers the nation's largest stock of tubing, plus Ryerson's fast delivery. Give him a call today.

RYERSON STEEL

Tubing in Stock: Seamless and welded mechanical tubing; fluid line, pump cylinder and structural pipe and tubing; polyvinyl chloride pipe and tubing; and aluminum tubing in many Ryerson plants.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI • CLEVELAND DETROIT • PITTSBURGH • BUFFALO • INDIANAPOLIS • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

Sharp Clean Cuts EVERY TIME

Many thicknesses and sizes of metal are cut on this Steelweld Shear every day. Thanks to Steelweld's exclusive MICRO-SET knife adjustment, it is easy to set the knife clearance to the exact amount which will produce the best cut for every plate run through the machine.

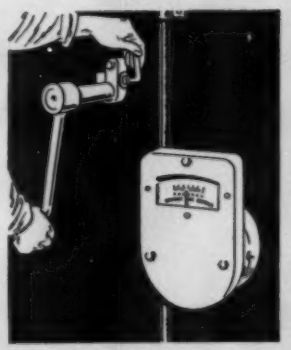
If desired, the knife clearance can be set for an average thickness and all plates cut without changing the clearance. This procedure is used with most shears because to change knife clearance on them is a tedious, difficult operation which usually puts a machine out of service for hours.

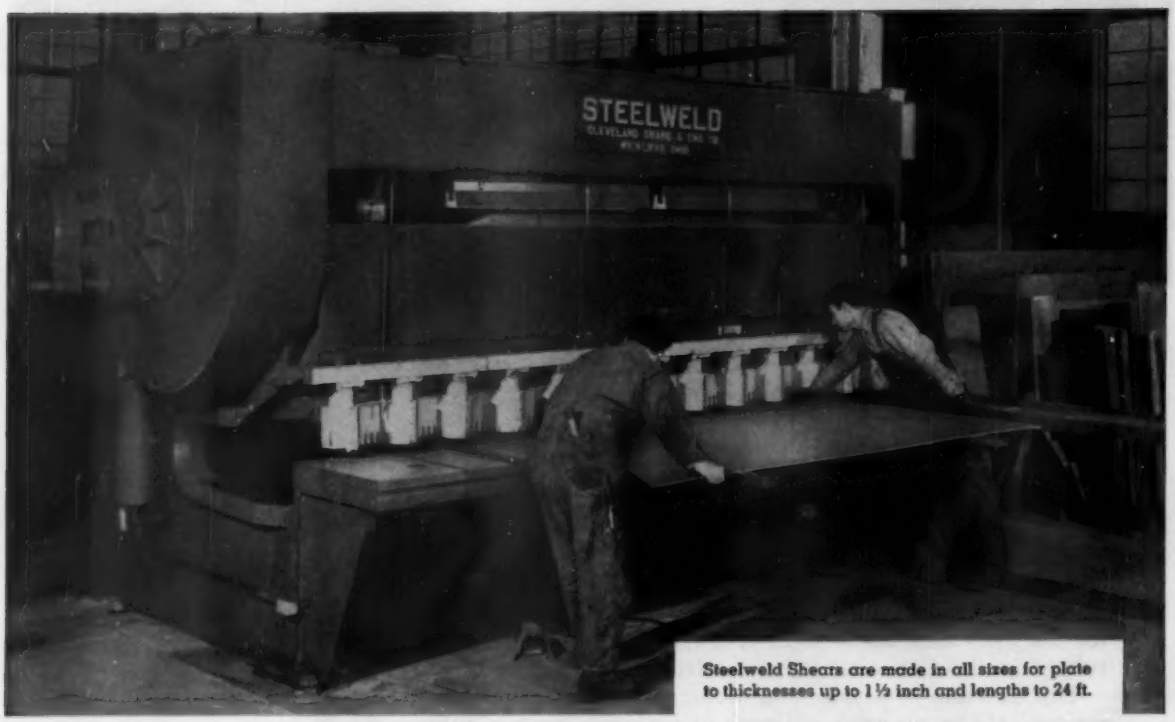
In contrast, knife adjustment on Steelwelds is made in a few seconds. It's simply a matter of turning a crank until an indicator points to the figure representing the thickness of plate being cut. No bolts to loosen; no parts to move. There is no need for using "average" knife settings.

The clutch and brake unit is another outstanding feature of Steelweld Shears. As it is air-operated, it is quick, snappy in action. Its low-inertia design assures cool operation, even after long continuous production runs, because energy to be dissipated is minimized and working pressure necessary on clutch and brake facings is greatly reduced.

The many features of Steelweld Shears make it worth your while to get all the facts.

Because of MICRO-SET Knife Adjustment





Steelweld Shears are made in all sizes for plate to thicknesses up to 1½ inch and lengths to 24 ft.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1446 EAST 282nd STREET, WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

American Machinist
MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

No Longer a Luxury

Though the Russians are ahead of us in rocket and missile performance, American industry is far from dragging its feet in its research and development activities in non-military products.

Metalworking is giving an up-and-coming account of itself in this field. This year alone it has spent some $4.7 billion for research and development work. Most impressive of all, the metalworking industries, representing one-third of all industry, are accounting for two-thirds of the total outlay in research and development.

These facts come as no surprise . . .

to those familiar with the magnificent research facilities of many large metalworking companies. These companies are pouring huge sums into developmental and experimental operations that improve manufacturing processes, that eventuate in new materials and new products, and that contribute notably to improving our standard of living.

Less well known is the degree to which the medium-size and small companies participate in research and development. The U S Department of Commerce has shed light on this phase of their activity in a survey of 500 smaller firms to find out how they solve certain technical problems and how they keep up with current developments. Many of the firms surveyed are in Metalworking.

"Product dynamics" is a fancy term applied to what these companies are doing. The most frequent problem confronting them concerns manufacturing processes and production equipment. This problem, in fact, outstrips all others combined in its urgency and in the attention paid it.

New product development is the second main category, with raw materials and finished components, product improvement, and quality control and product maintenance following in that order.

Experiments within the plant . . .

comprise the principal method of dealing with "product dynamics." Perhaps surprisingly, the smaller manufacturers next turn to their suppliers for help, many of the suppliers being companies much larger than themselves. Trade and technical literature is a major source of information used in solving technical problems, the smaller companies say. More than that, the survey states that "the trade or technical journal was the primary source of current news on new developments among three of the industries [including Metalworking] studied."

The survey makes clear . . .

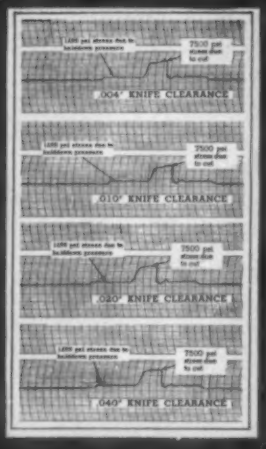
that scientifically oriented firms are in far stronger positions than firms not scientifically oriented to solve technical problems and to put to work current technical developments.

That conclusion, in itself, should be the tipoff to management that investment in research and development pays, whether a company is large or small. In these fast-moving times, research and development work is not a luxury but a necessity for every metalworking company.

Burnham Finney EDITOR

CINCINNATI accurately shears thin sheet and heavy plate without changing knife clearance

This machine is a good example. It's a 4310 Series Cincinnati, with a capacity of ½" by 10' mild steel. The photos show it accurately shearing ½" plate and 20 gauge sheets . . . with the same knife clearance.



You don't have to change knife clearance each time you cut a different thickness on a Cincinnati Shear, with the knife clearance set for thin material, Cincinnati Shears will accurately cut all thicknesses up to capacity.

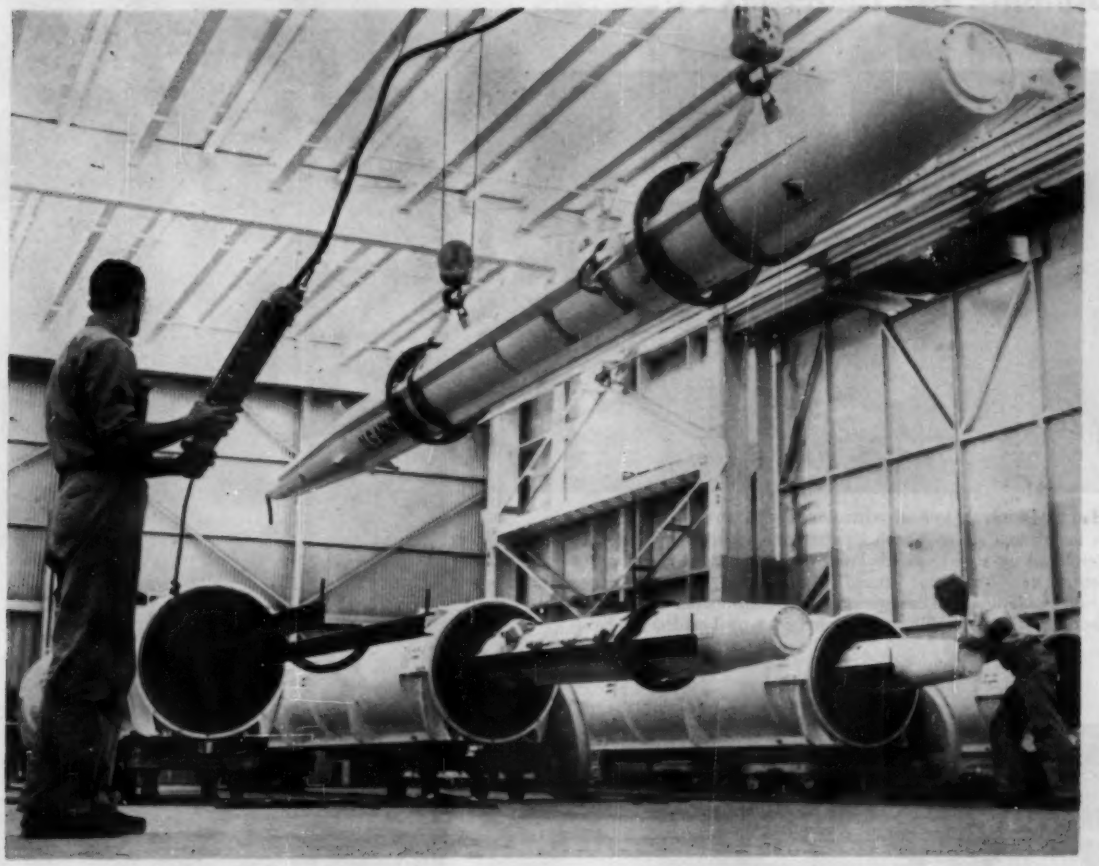
This statement is being demonstrated daily, by thousands of Cincinnati Shears in operation. Carefully conducted engineering tests have proven the following facts:

- Knives last just as long when cutting different thicknesses with one knife clearance, as when clearance is changed for each thickness.
- A Cincinnati Shear works no harder when cutting with a close clearance than it does with a large clearance.
- Shearing with one knife clearance is safe, since thin sheets cannot become accidentally wedged between the knives.
- Cincinnati Shears with single knife clearance are time-savers, since the unnecessary clearance-changing operation is eliminated.

The results of these tests are shown at the left. For complete information on Cincinnati All-Steel Shears, write Department A for Catalog S-7R.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS · SHEARS · PRESS BRAKES



Completed missiles are loaded . . . into shipping containers with internal cradles to support the missile and protect it from impact shock in shipping and handling. Containers are sealed to provide protection against contamination

THE NIKE-AJAX: Building the first mass-production missile

ANDERSON ASHBURN, managing editor GEORGE H DE GROAT, Detroit editor

In tooling for mass production of the Nike missile, Douglas was moving into uncharted territory. All the original manufacturing operations on the missile components were first put into production and proven out in Douglas plants.

In the crash production program that developed, however, it was necessary to make use of numerous vendors. At present, four major subcontractors and more than 200 vendors contribute to Nike-Ajax production.

Production of parts to the exacting standards required for missiles and in quantities much greater than normally encountered in aircraft work required the development of many special machines and techniques.

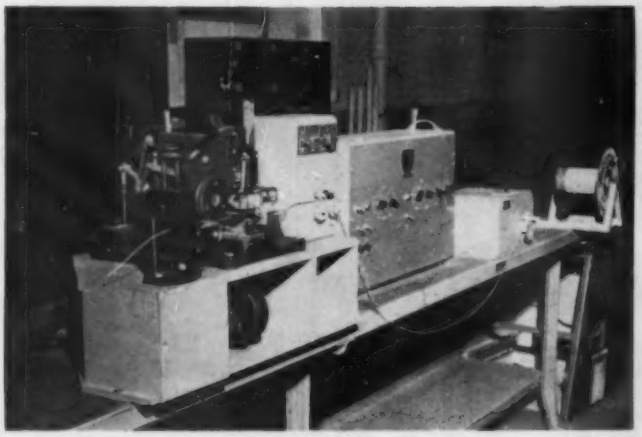
All sheet metal parts are die-cut rather than routed by the usual aircraft methods.

Honeycomb filler for fins is made from Aircomb, a phenolic Kraft material that is first die-cut to shape and then machined to contour on the special core mill illustrated (next page).

Two cutting heads on this machine each include a bandsaw to rough cut and an abrasive belt to finish the surface. Three different plane surfaces must be cut on each side of the sheet of honeycomb.

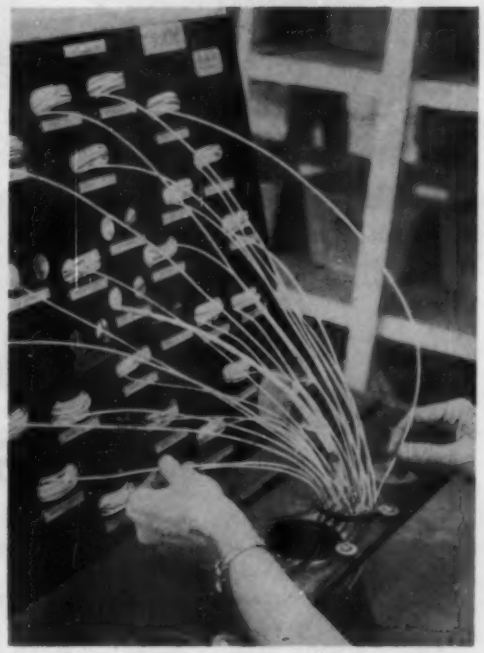
Honeycomb is loaded into a fixture running on cam tracks that provide the right approach angles to cut the three plane surfaces on one side in a single pass under the two heads.

Building the Nike-Ajax . . .



Harness wires are automatically cut . . .
to length and stamped with identification numbers in this Lydolph marker, developed by a Douglas employee from a standard marking head. Dials on control unit are set for desired length and wire is fed to automatic cut-off head. Code numbers are stamped on the insulation at required intervals at the same time. Marking tape is fed from reel under the head

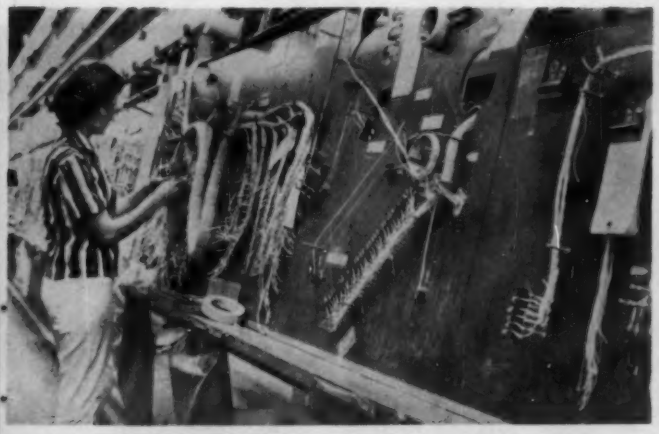
Wiring jig for missile harnesses . . .
is fed from a board containing various lengths arranged in a circular pattern corresponding to holes in the jig. Wire is then prepared for harnesses by adding leads and assembling to the missile components



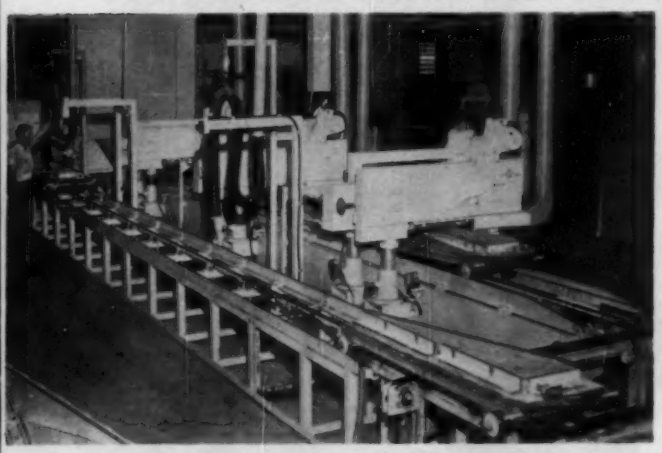
The honeycomb is then inverted and placed in a similar fixture with a formed bottom to fit the machined side of the work. Six of these fixtures (three of each type) alternate in the circuit through the machine. Flexible overhead vacuum lines are provided to clear chips from work and fixtures at loading and unloading stations.

Another novel development by the Douglas tool engineers was required to provide the volume needed in bonding the honeycomb and skin together for fins. The bonding cycle requires both heat and pressure for 45 min. To provide maximum production rates, hot-oil or "pants presser" dies were developed.

Upper and lower mold halves of the shapes required for booster and main fins have stainless-steel diaphragms. The assembly of skin, sheet adhesive, and honeycomb is placed on the diaphragm of the lower mold and the counterweighted upper mold is closed and clamped with cam locks. Oil heated by



Mobile wiring jig . . .
simplifies assembly of complicated wire combinations. Wire is taped and tied in accordance with an outlined diagram and with coded instructions. Completed assemblies in the jig moves alongside the assembly line for installation of the wiring in the missile



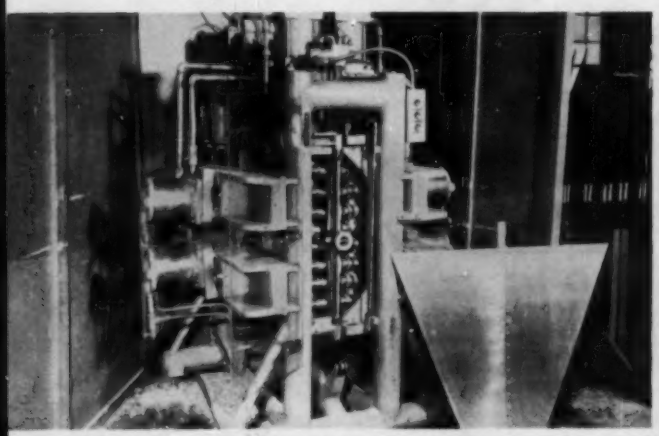
Core mill . . .
cuts three different planes on each side of the filler sandwich in missile fins. This honeycomb is loaded into a fixture traveling on cam tracks that bring it at proper approach angle under heads containing a bandsaw blade for roughing and an abrasive belt for finishing

This is the NIKE-AJAX

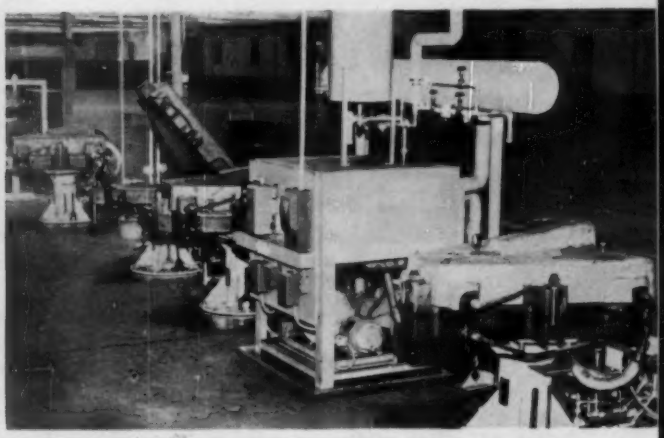
Nike-Ajax, a liquid-fuel rocket with a solid-fuel booster, was the first missile to enter operational service in defense of the United States. Developed for U S Army Ordnance, the anti-aircraft Nike missiles are located at numerous batteries in strategic locations thoughout the country. From these batteries the missiles can be directed by radar to intercept invading bombers.

Research and development for the Ajax has been a major project at Douglas Aircraft Co since 1945. Nearly five years of development were required to get the missile into production. Initial facilities were established at Santa Monica. Later a duplicate facility was established at the Charlotte (NC) Ordnance Missile Plant tooled and operated by Douglas for U S Army Ordnance.

The Douglas Charlotte plant is now in full production on Nike-Ajax missiles and is also starting production of the newer Nike-Hercules—the nuclear version of the Nike.



Typical of special tooling possible . . .
in production of missiles is this Douglas-designed air setup to drill 54 holes in booster fins. Fixture is clamped between offset drills that produce holes from both sides of work



Hot-oil dies . . .
for bonding honeycomb to skins have stainless-steel diaphragms on both upper and lower mold faces. Oil is heated by steam and pumped from reservoir in center to entire line

Building the Nike-Ajax . . .

steam to 325 F is pumped into the mold halves. Pressure as well as heat is transmitted through the thin metal to cure the adhesive.

TRAINING PROGRAM

In opening the missile plant in Charlotte, one of the major problems Douglas faced was training. Most of the employees were hired locally, though the initial work force was filled out by people borrowed from other Douglas divisions. At one time 45% of the men in the toolroom were trainees.

Machine operators were trained by the buddy system, augmented by conferences to fill in those points the experienced man doesn't teach because he knows them so well he forgets to bring them up.

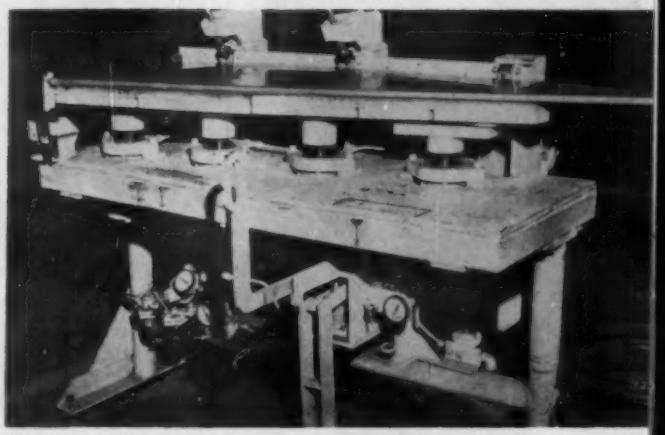
This informal training method was used with great success in training men for the machine shop, toolroom, and fabricating shop.

Most of the millrights formerly were experienced loom fixers in textile mills and proved readily adaptable to work on machine tools.

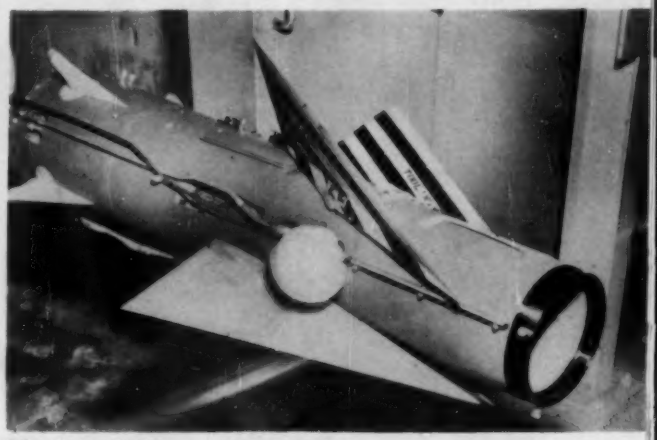
For assembly operations, which involved work entirely different from anything existing in Piedmont North Carolina, before, it was necessary to set up a training school with jigs, portable tools, and other equipment to handle the aircraft type of assembly.

The only acute shortage in filling out the force in N C has been in people with junior college and trade school training, both of which are relatively plentiful in California.

Shown on these pages are some of the unusual methods developed by Douglas to produce the Nike-Ajax. Some of the pictures were taken in the original facility at Santa Monica, and some were taken at Charlotte.

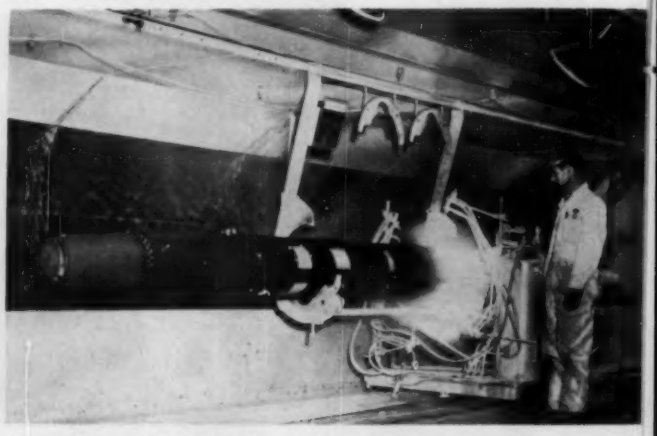


Proof test is made . . .
to check the adhesion in all bonded assemblies. The fin is fitted in the fixture and a fixed pressure is applied with hydraulic cylinders when the operator steps on the pedal. Deflection of the fin is measured on the gage at the front corner. A defective bond shows up clearly as excessive deflection

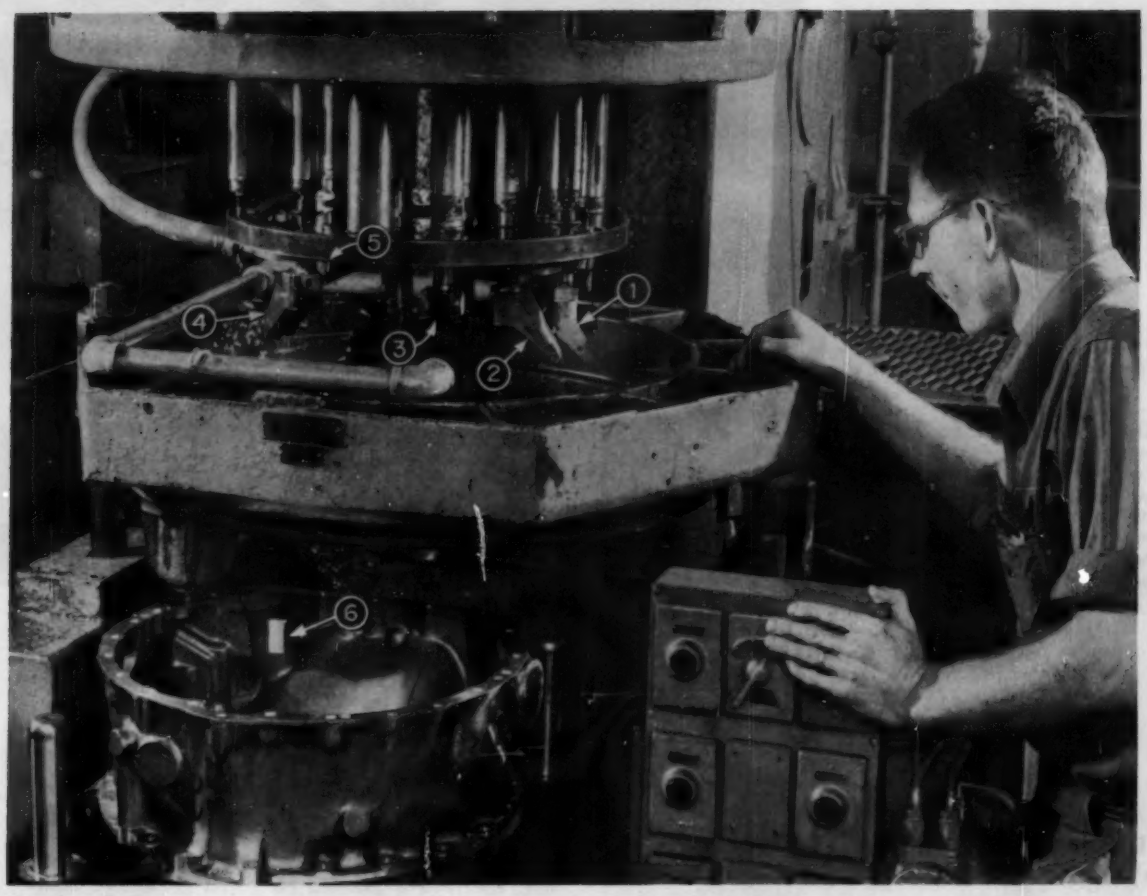


Plastic bubble-gum detects leaks . . .
in pressure chambers. With this material, even if the bubble bursts, remnants will show the area of the leak for repair

"Pants pressers" . . .
is the shop term often used for this group of bonding dies. The flexible diaphragm that transmits both heat and pressure can be clearly seen in foreground



Automatic paint spray head . . .
applies hot enamel. This Douglas-designed mobile unit travels back and forth on rails to paint the outer skin of the missile as it passes the spray booth on an overhead conveyor



Dog-leg fly-cutters . . . are designed so one cutter can swing under the shank of the next nearest cutter. Cutter 2 is interlocking with cutter 1 with a clearance of about ⅛ in. at closest point. Similar clearance is obtained between cutters 2 and 3. A typical cut made by cutter 5 can be seen at 6 where clearance space has been milled

Interlocking fly-cutters mill overlapping spots

NORMAN W COTE, assistant chief, Process, Planning and Development Engineering, LYCOMING DIV, AVCO MANUFACTURING CO, STRATFORD, CONN

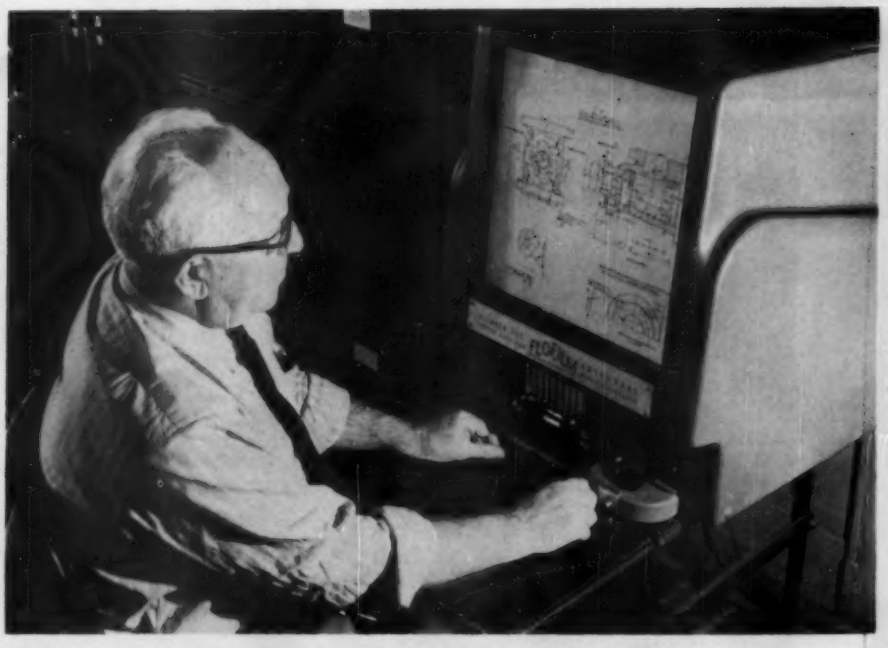
Five clearances that formerly had to be milled one at a time, because of overlap, are now milled "free" at the same time that step holes are drilled in the part.

This problem arose in the supercharger rear housings for R-1280 radial engines. The clearances are required to permit the assembly of rear cover gears and were end-milled one at a time. A suggestion by the line foreman, William Miller, that we combine non-intersecting cuts by building multi-spindle geared heads, led to a study of all other possible combinations.

In addition to the five milling cuts, there were two jack-screw parts on the flange face and five combination reamer cuts around the center bore that were done separately. A layout indicated that all could be done at once on a Natco vertical multi-drill if the interference could be eliminated.

This was solved by an accurate tool layout using timed interlocking fly-cutters as illustrated. To avoid damage these cutters have off-center tangs on the shank and driver in addition to a tool set-up sheet showing the proper angular relationship between them.

In addition to the saving that comes from combining the separate milling operations with the drilling operations, this machine runs on a multi-machine standard with adjacent automatic-cycle machines.



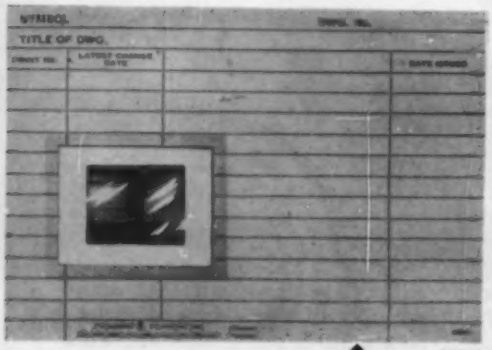
Drawings can be read . . . on the screen of this enlarger (mounted on a typewriter stand for portability) which is provided in Rockwell's archives dept. Microfilm readers in the new technical library put all design data at engineers' fingertips

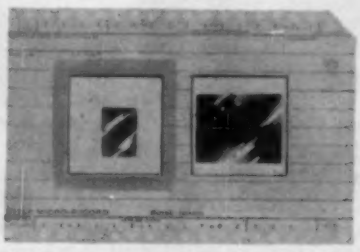
Filmed records save space,

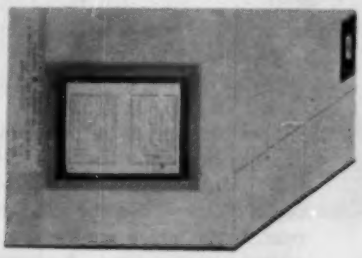
Two companies, Rockwell Manufacturing Company of Pittsburgh and the Heald Machine Company of Worcester, Mass, a subsidiary of Cincinnati Milling Machine Company, proclaim the many benefits of microfilmed records. Advantages include space saving; rapid review of drawings, reports, and orders; disaster protection; convenience. Heald mounts film on individual index cards, Rockwell stores it in rolls.

Whether in the shop or the engineering department, the principal records such as engineering drawings, blueprints, standard procedures, specifications, and work orders must not be permitted to become static. For, if this happens, and all too often it does happen, the seed is planted for rapid growth of delay, inefficiency, waste, and poor quality. Nevertheless, when these records—among the most active in today's industrial life—are consigned to out-of-the-way storage, it is easier to "guess" or "take a chance" than to dig out the spec or the latest print. Trouble quickly follows.

Because of their bulk engineering drawings take up valuable space; must be stored where they do not interfere with production space requirements. Heald has about 400,000 drawings on file and is adding to them at the rate of 30,000 new drawings each year. By using microfilm mounted in 3 x 5 in. Filmsort-aperture index cards, floor space requirements are greatly reduced—to only 11 10-drawer card-file







Aperture cards . . . are used by Heald to index drawings, sketches, specs, and orders. Available in Remington-Rand, IBM, and a variety of other index-card forms, this method requires more space

Hand viewer . . . for aperture cards simplifies location and checking of microfilmed information. For printed matter or quick reference this device provides sufficient enlargement—and saves time. It now is possible, through closed-circuit television, for a tool designer or an inspector to call a central file for a specific print or spec and have it appear on a screen at his desk

time, and heartaches

cabinets. More importantly, however, the records are convenient to the people who must use them.

In these days of the 10- to 25-cent minute, delays in going to basement storage vaults or in locating current drawings from among thousands in the various departments were proving costly to this New England machine-tool builder. And to the tangible costs in look-up time were added the intangibles of irritation and frustration—to production people, engineers and clerks alike.

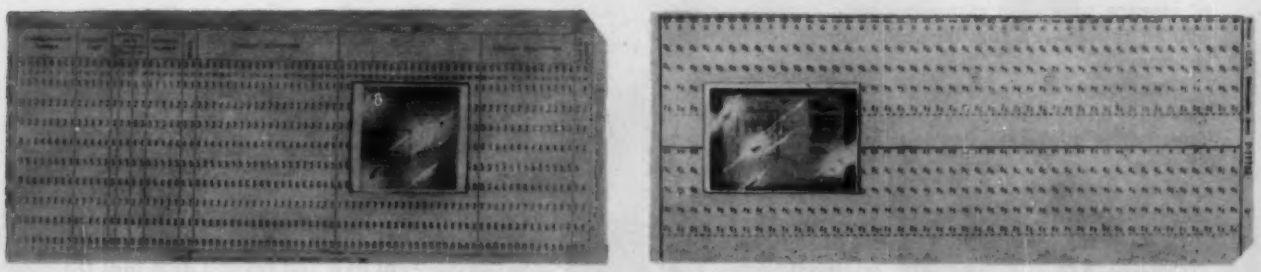
Microfilming was originally installed at Heald for security reasons—following the lesson of the Worcester tornado. About half of the 400,000 engineering drawings are consulted at one time or another. There were, for instance, more than 3000 referrals to old drawings or microfilmed copies last year. About 90% of these referrals required at least one new print of a drawing.

Today, with volume more than twice that of the pre-microfilming days, the greatly increased number of filings, referrals, and the processing of reproductions still is handled by one girl. Look-up time is reduced to a few seconds rather than the many minutes it averaged under the old system.

Because the company already owned a microfilm camera, the outlay was minimized. Reels of film, exposed at the plant, are processed into Filmsort aperture cards by a nearby microfilming service bureau. An inexpensive viewer and print-making facility was placed in Engineering so that magnified images of microfilmed drawings can quickly be consulted—and reproductions can be made as they are required.

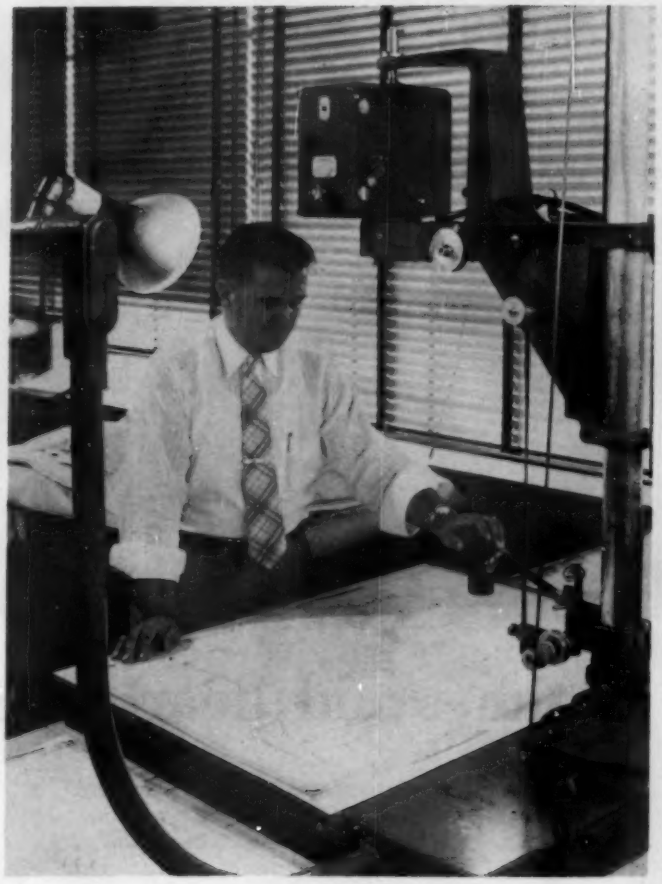
(Techniques now under development will soon provide automatic card selection, without shuffling, by a numerically controlled device.)

By microfilming all product and tool drawings, bills of material and specification sheets, Rockwell, too, has insured itself against the loss of its accumulated engineering know-how in a catastrophe.



than the simple roll-film method but provides more rapid location and identification as well as pertinent information regarding the material filmed

Filmed records save space, time, and heartaches . . .



Larger drawings . . .
are photographed at a rate of 2000 per day, at a cost of about $30.00 per thousand, at the Rockwell plant. Worn or soiled drawings are reproduced better by photography than by other methods. Special photographic skills are not essential and the techniques are readily learned

Similarly, the day to day advantages of a central microfilm file have justified the program cost, even without counting the value of disaster protection.

A central microfilm file has proved particularly advantageous to Rockwell because of its broad product and geographical diversification. At Rockwell, 15 research and development centers produce drawings for 18 product lines (25,000 types and sizes) manufactured in 19 plants.

To meet changes in the production organization, drawings are transferred directly from one plant to another. Meanwhile, the central file in the company's Pittsburgh headquarters provides extra insurance against loss in transfers. In one such transfer, a set of product drawings—worth thousands of dollars in engineers' and draftsmens' time—was lost. The drawings were readily reproduced from the microfilms. In another case, a complete set of engineering reports was misplaced. Rather than tear everything apart to find the missing set, Rockwell engineers used the microfilm file to replace the reports.

Just as important is use of the central file for servicing installations of Rockwell equipment. Customers sometimes request service years after equipment was installed. Storing drawings for these products and finding a particular drawing when required was a time-consuming and expensive burden. Now, divisions need not save obsolete drawings. Copies are obtained from the archives department, which is set up to handle microfilming, when needed.

SAVING AND COST

In addition to the convenience in finding a drawing, considerable space has been made available by using the central file. Clear-cut photos of 36,000 drawings ranging in size from 6 by 9 in. to 30 by 48 in. can be accommodated in slightly over one cu ft of storage space—as compared with approximately 500 cu ft required for the same number of original drawings.

The Archives also provide reproduction of old, faded, soiled or worn drawings. Blueprints reproduced from film are clearer than those made from all except the newest drawings. Using microfilms instead of retracing worn drawings provides a considerable saving.

Costs of maintaining the central file and servicing requests from divisions are relatively low. The Archives can photograph bills of material, index sheets, and small drawings from $10.00 per thousand and drawings larger than 14 in. square for about $30.00 per thousand. Rockwell estimates that these costs are roughly half the cost of having the work done outside the company. Initial cost of each camera was about $1600.

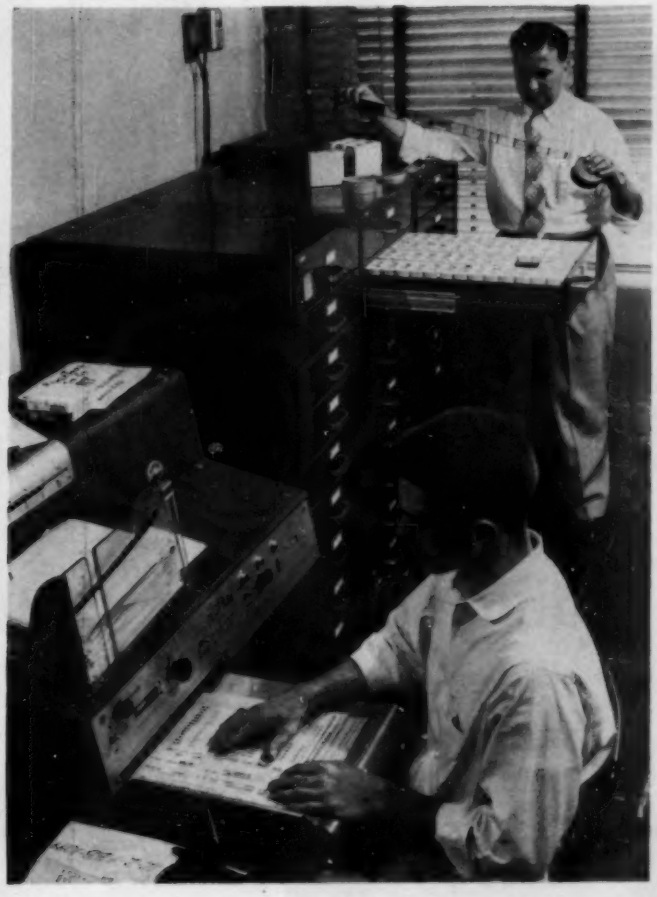
Since the microfilming program started, the archives department has photographed nearly 400,000 sheets, averaging about 2700 per day. It costs about 28 cents to reproduce an 8½ by 11-in. sheet and for larger drawings, about 40 cents per sq ft on paper, 75 cents on vellum and $1.50 on cloth.

Rockwell also uses its microfilming facilities to prepare sales material. Specially prepared material is particularly valuable to the Delta Power Tool Division as its products are sold through distributors and Delta salesmen are often called upon to explain the advantages of the tools to a distributor's sales force. The archives department prepares special slides for this purpose.

HOW IT WAS DONE

To start its microfilming program, Rockwell installed two cameras in a truck which visited every research and development center and made copies of all drawings on file. To keep the file up to date, each division sends copies of new and revised drawings to the archives department which puts them on film.

Archives retains one positive copy and sends the



Six hundred drawings . . .
are preserved—readily available on one roll of 35-mm film, which cost about $6.30, including processing charges. Machine in foreground is automatic camera used to process smaller-sized letters, drawings, spec sheets, invoices, etc

negative to a safe-deposit vault. Archives keeps no index but returns a list of drawings that have been filmed and their location in the files to the division. Each division maintains its own index system. This method keeps the cost of the central file no higher than it would be if it were used as catastrophe insurance only.

Divisions wanting drawings from the central file request them from Archives by specifying the negative and its location in the central file.

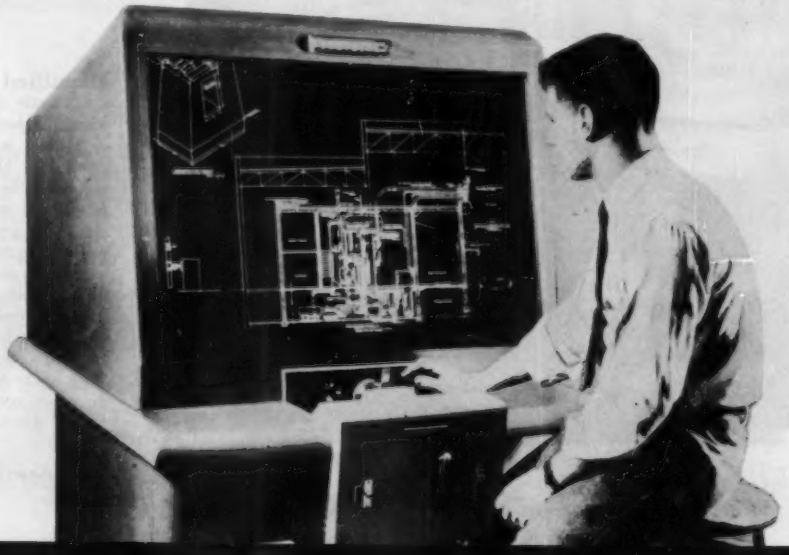
FUTURE USES

The Archives Department now has a viewer for reading microfilm directly from the positive. Other viewers provided in the new technical library enable the headquarters engineering department to call for any drawing from any Rockwell division without the expense or time involved in reproduction. Microfilm copies of all company engineering reports will be kept in the library.

Thus we have the experiences of two companies in the use of microfilm, with each company launching its program for security purposes, only to find decided efficiencies in other areas. For the years ahead, the philosophy of microfilming is inherent to the whole pattern of scientific information processing.

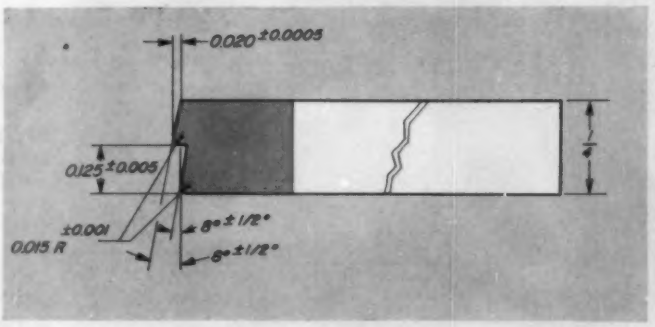
As we enter the age of numerical control through tapes, cards, and computers, of automatic program control, quick-locating memory systems are imperative. Similarly the volume of information must be reduced for space saving as well as simplicity of use. As increased complexity increases the need for specific reference, the cost of reference time must be minimized. Microfilming, and its many ramifications, contributes to all of these needs.

Even at typical rates of $2 per sq ft annual rental or $12 per sq ft minimum construction cost for additional space, a reduction in volume of 500 to 1 cannot be ignored. Add to this the saving in time, storage equipment, and avoided errors, plus the insurance factor if disaster strikes. The result is too impressive to ignore. Information handling offers as much potential for saving as materials handling.



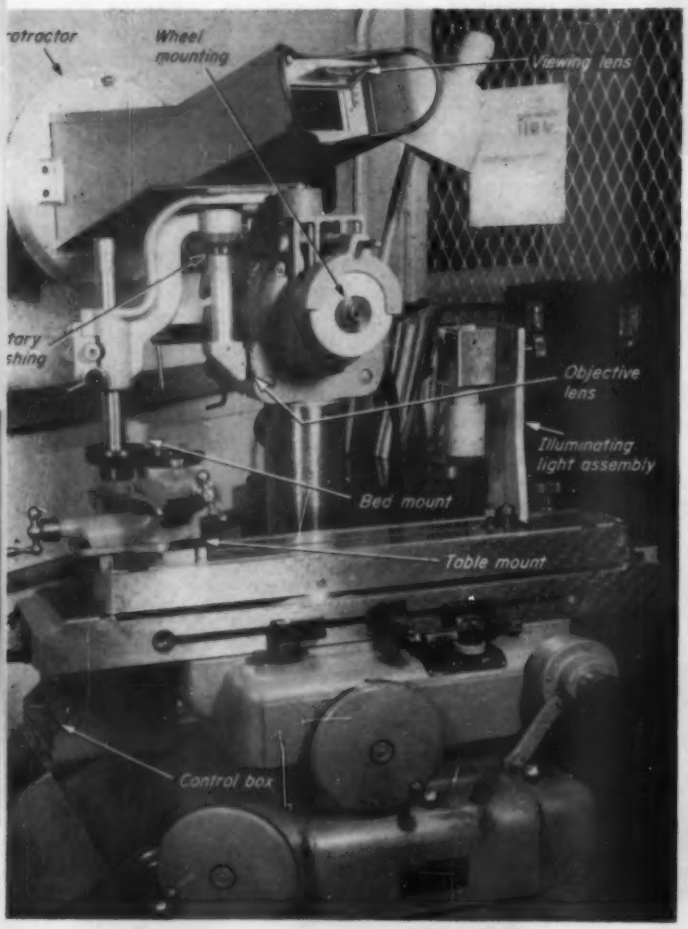
Detailed study . . .
of complicated drawings is done with the help of a projector viewer which provides a large clear picture on a groundglass screen. Either aperture cards or roll film can be projected

Form tool is typical of many such tools formerly purchased from outside sources by MPB because their tool grinding machines were incapable of accurately generating profiles. MPB was limited simply to the resharpening of such tools on their cutter-grinders. Recently, a project was undertaken that would permit the visual grinding of all operations on form tools at a nonprohibitive cost. By equipping a K O Lee cutter-grinder with a Stocker & Yale optical system, MPB is now successfully grinding carbide-form tools from blanks. Here's how the adaptation of the optical system to the cutter grinder was developed



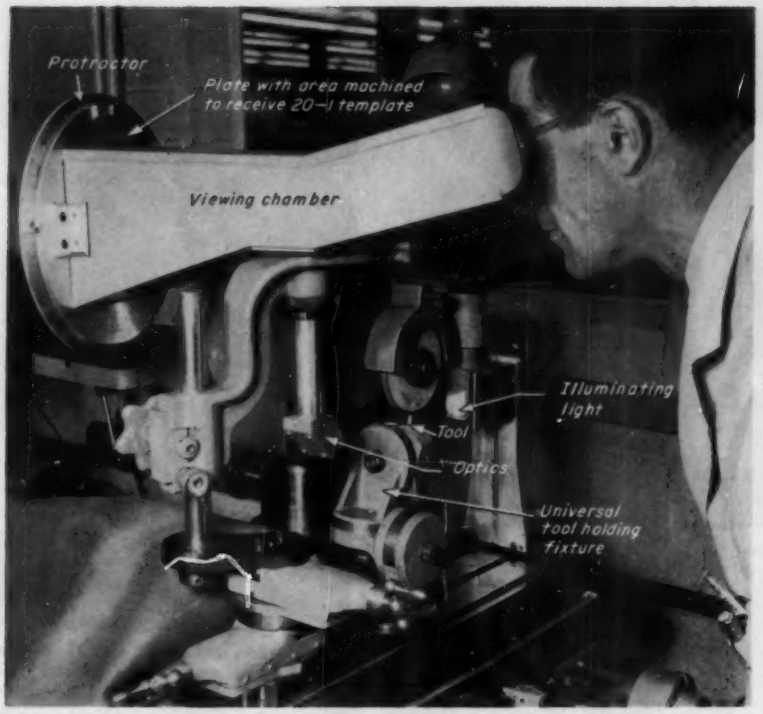
Projector Adapted to Grinder Solves Form-Tool Problems

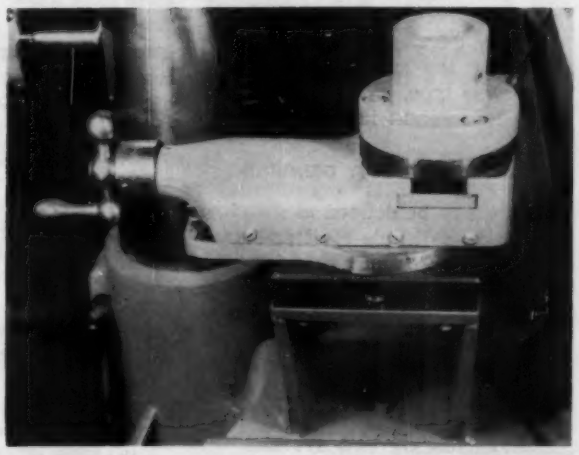
J RICHARD SLOAN, development engineer, MINIATURE PRECISION BEARINGS INC, KEENE, N H



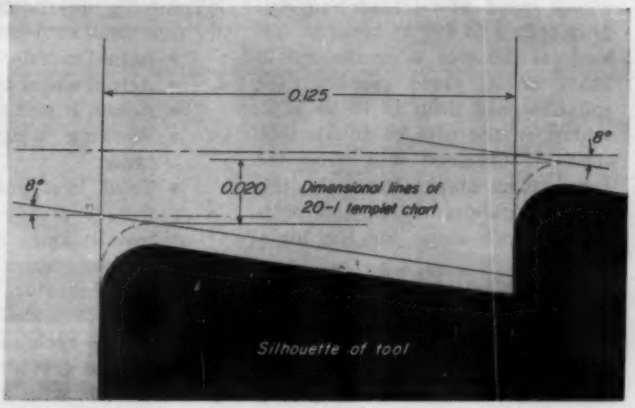
Are you grinding form tools by the hit and miss method? If you are, it's more than likely because you can't afford the expensive equipment that will enable you to control your form-grinding operations accurately. Here is one inexpensive method that will enable you to precision-grind form tools without increasing tool cost. Take an optical projector and adapt it to your cutter-grinder. Now all your operator has to do is view the wheel-tool engagement on a screen, and grind the tool profile to conform to a 20:1 templet

Magnified view of grinding operations is through a silhouette of the tool profile engaged with the grinding wheel projected upon a screen. Skillful manipulation of grinder worktable allows the operator to accurately grind tool blanks to conform to a 20:1 templet. Fixturing of the tool is identical with or without the new adaptation until the point is reached where the radii are to be ground. At this point the adaptation permits precision grinding of radii with a standard radial-grinding fixture and a diamond-cup wheel. To allow flexibility of illuminating light for centralizing purposes, the lamp base mounted on the elevation plate contains a mortise and tenon that permits adjustment in a longitudinal and transverse direction. Threaded wheel-mounting adapters were made to provide quick interchangeability of permanently-mounted wheels on the wheel-spindle, and to assure identical relocation of grinding wheel





Adaptation of projector is accomplished by mounting it on two lathe cross-slide attachments secured to grinder worktable. Bottom compound adjusts focal length, while top compound aligns optic-lens system to work. A second modification, shown in photo below, consists of one cross-slide lathe attachment mounted to bed of machine. This unit is positioned at a 45° horizontal angle to the work. Thus, the machine is provided with two mounting positions for optional focusing of projector. With optics mounted on worktable, the work and wheel are always in focus. Mounting optics on bed of machine keeps the wheel always in focus for wheel-dressing operation. Optics-lens system is equipped with right angle and vertical projection. The magnifying glass was removed from the viewing chamber, equipped with hinges, and remounted in its original position. This modification was made primarily to eliminate light reflections and thereby obtain a more clearly defined image on templet when magnifying lens is lifted. By so doing, the observer is looking into the chart, and not through the magnifying lens. Projector was further modified by adding a protractor that now allows charts to be rotated through 360°. Optics lens was fitted with a protective glass for obvious reasons



Here's the view the operator sees as he looks into the viewing chamber. Silhouette of tool is shown approaching dimensional lines on templet chart. Usually the grinding wheel is also silhouetted. Many advantages have been realized with the present modification of the cutter grinder. Of prime importance is the fact that now all grinding operations are visually controlled rather than controlled by dial readings. Subsequent advantages are: form tools now ground to specification, setup and down time reduced, grinding time reduced 50%, lower tool-rejection rate, conservative 20% reduction in tool costs, and uniformity of tools resulting in an improvement of quality and uniformity of parts produced

360-CYCLE PORTABLE TOOLS:

why they make sense for Heavy-Duty Grinding

M A HORLAK, development engineer
ROTOR TOOL CO, CLEVELAND

Tool was held at slight angle to test block, then worked back and forth along axis of block. Tests made this way under controlled conditions can be repeated within close limits

360-cycle portable tools are tools driven by 360-cycle alternating electric current instead of the usual dc or 60-cycle electric power used in "universal electric tools." These 360-cycle tools, along with air tools, are generally assumed to be worth their higher cost because they are more productive; but where do 360-cycle tools have advantages over air tools in the heavy-duty abrasive field? This report and analysis of test results (from a company that makes both types) gives the answer.

The fundamental advantage of a 360-cycle tool is its ability to maintain almost constant speed under load. Thus a grinding wheel can be operated practically at the top safe-wheel speed at no load and will drop only 3 to 6% in speed at full load. If the tool is overloaded to 225% of its rated capacity, the spindle-speed drop is 10 to 12%, where, in the case of an air tool, such an overload will drop the speed much more. Obviously, this means high production and optimum wheel usage for the high-cycle tool.

The 360-cycle current is usually obtained from an independent motor-generator set which produces 220-volt, 3-phase, 360-cycle current. The tool motor is a simple induction type with a unitized brazed-copper, squirrel-cage rotor that runs nearly at synchronous speed. Many users are familiar with 180-cycle tools, but the more recently developed 360-cycle type provides the same power as the 180-cycle type, but with considerably less weight in the tool itself.

WHAT IS HEAVY-DUTY GRINDING?

This may be defined as grinding on large malleable-steel and nonferrous castings, heavy welds, inspection bars, and so on wherever substantial amounts of metal are removed. Work with a 9-in. sanding pad or heavy-duty buffing or polishing also belongs in this field.

COMPARISON OF TWO SYSTEMS

The tools may be compared under five basic subjects:

- Actual metal-removal cost
- Actual wheel cost
- Actual power cost
- Working weights of both types
- Total investment required for air or 360-cycle power installations, including the air compressor and the motor-generator.

In order to make comparisons between 360-cycle and air-powered portable grinders, a series of practical tests was made to duplicate existing shop conditions. These tests, in turn, were compared with actual case histories covering recent installations.

TEST SETUP

SAE 1010 bars—3 in. wide, 1½ in. thick, and 16 in. long (each weighing about 20 lb)—were clamped to a steel bench at convenient height. Test bars and wheels were weighed accurately before and after being ground to show metal and wheel losses. An accurate Toledo balance was used because metal-removal tests made on the basis of weighing on kitchen scales, or other inaccurate scales, are practicaly valueless. Experienced grinder hands were borrowed from a local steel mill—men who are accustomed to getting maximum metal removal from portable grinders because they are paid on a tonnage basis. It has been our experience that metal-removal tests made by machines have proved disappointing over the years because it is difficult to estimate the amount of pressure that should be applied by the machine in order to duplicate practical working conditions, and we find

360-CYCLE PORTABLE TOOLS . . .

that users are always skeptical of artificial machine tests.

A complete range of tests was made with air pressures of 90, 80, 70, and 60 psi, as indicated by an air gage mounted on a union between the inlet of the tool and the coupling on the end of the hose. This arrangement shows the actual pressure delivered to the tool while the tool is operating, and includes any drop of pressure through the final coupling. However, the final fitting or quick-disconnect coupling sometimes causes rather surprising pressure drops at this point. Measurements made with an air gage at a union can be compared accurately to pressures found in the field in the same way; pressures which, of course, practically never reach an actual delivered 90 psi and may often read as low as 60 psi.

Hypodermic needle on air gage is adequate field checking equipment if needle is inserted close to final coupling. Note pressure drops even here; 92 psi at flowmeter, 90 psi at needle gage, and 85 psi at pipe T

TEST CONDITIONS

Good practice, however, for comparing performance of heavy-duty air tools and 360-cycle tools requires a delivery of 80 psi, as used in the final tests. Pressures lower than this represent poor shop conditions which should not be tolerated.

Our test made at 90 psi actual pressure at the tool inlet (which meant stepping up the compressor to 125 psi and using extreme care in pipes, hose, etc), showed surprisingly little difference between metal removal of a heavy-duty air grinder and 180-cycle or 360-cycle portable tools. These ideal conditions, of course, are practically never realized.

After studying the complete set of tests (not shown fully here) it is evident that as horsepower applied is increased for heavy-duty grinding, metal removal is increased in nearly direct proportion.

In comparing air tools with the 360-cycle tools, only a heavy-duty air tool should be compared with the comparably powered 360-cycle, as the light- and medium-duty tools do not remove sufficient metal stock.

As pressures drop below 80 psi delivered at the inlet of the tool, the metal-removal rate drops noticeably. In some cases the drop is larger in one motor than another, depending on the size of the motor itself. Where tools in the field have been in use, say, 6 months, obviously the power output has dropped through wear and naturally the metal removal will also drop, nearly in direct proportion. While it is reasonable to expect that air tools should be serviced to 80% of their original power, this is often not done because of inadequate maintenance, and the power drop becomes even greater.

Our conclusion is that tests made under predetermined and controlled conditions of 80 psi at the end of the tool, while the tool is under load, represent the actual work output from a practical point of view where air tools are proper-

METAL-REMOVAL TESTS: AIR, 180- & 360-CYCLE HEAVY-DUTY TOOLS

	Air Tool	180* Cycle	360 Cycle
Speed, rpm	6000	5600	6000
Power	3.80 hp	3000 watts	3000 watts
Metal removal, oz/hr (Air at 80 psi)	76.0	89.0	103.2
Weight "pick up" including wheel guard and cable, lb	19.2	22.8	19.2
Wheel loss, oz/hr	12.7	11.4	10.0

* Metal removal of tool would be higher at 6000 rpm

COMPARATIVE INVESTMENT FOR VARIOUS GROUPS OF HIGH-CYCLE AND AIR TOOLS WITH POWER SUPPLY

		Tool Cost	Power Supply Cost	Total Cost of Tools and Power Supply
10	H C Tools	$ 2,625	$ 3,280. (15 kw)	$ 5,900
10	Air Tools	2,340	5,950. (362 cf)	8,290
19	H C Tools	4,625	5,314. (30 kw)	9,979
21	Air Tools	5,015	13,875. (689 cf)	18,890
28	H C Tools	7,260	7,092. (40 kw)	14,352
31	Air Tools	7,355	18,817. (1019 cf)	26,172
38	H C Tools	9,910	9,174. (50 kw)	19,084
41	Air Tools	9,695	24,538. (1378 cf)	34,233
76	H C Tools	19,820	16,491. (40 kw) (50 kw)	36,311
82	Air Tools	19,390	50,235. (2748 cf)	69,625

Direct comparison of three tools shows metal-removal advantage of 360-cycle tool, lower wheel loss for 360, weight disadvantage of 180. Systems comparison shows financial advantage for 360-cycle tools

Case study on light- and medium-duty work: diesel-engine crankshaft is cleaned up by 360-cycle tools. Time saving is 17%; time to repay cost of new tools is 24 weeks

Actual working weight includes either an air hose (at 3½ lb) or power line (at 0.8 lb), plus the usual guard and wheel

ly set up. If anything, they possibly show a slightly better performance than is actually found day-to-day in the field under reasonably good shop conditions.

FACTS OF METAL REMOVAL

According to the last column in the first chart, we find the metal removal is 103.2 oz/hr. This compares with the metal removal of the heavy-duty air tool, under practical conditions (80 psi) of 76 oz/hr. This means an increase in production of $\frac{103.2 - 76.0}{76.0}$ or 36%. Expressed in terms of savings, $\frac{103.2 - 76.0}{103.2} = 26.4\%$.

The realized value of this in dollars is figured as follows: The cost of the man working, say, $2.00/hr, times 8 hr/day, is $16.00/day. The savings are 26.4% of $16.00, but since the tool is actually in use only 45% of the time under heavy duty grinding conditions, these savings must be computed as follows:

0.264 x $16.00 x .45 = $1.90/day, net realized savings. If the computation is on the basis of increased production, the figures are:

0.36 x $16.00 x .45 = $2.59/day.

ACTUAL WHEEL COST

The wheel loss in oz/hr for the 360-cycle tool is 10.0; and for the heavy-duty air tool is 12.7. The saving is 2.7 oz/hr. Wheel cost may be figured on the basis of 15.4¢ per usable ounce, taking a 6-in. wheel and, assuming it is worn down to 4 in., dividing the weight of the wheel lost into the price of the wheel itself. This means that the savings per hour is 2.7 oz x 15.4¢, or 41.6¢ (or for an 8 hr day, $3.33). Since these wheel savings are again on a 45% factor of use, multiplying $3.33 by 45% shows actual savings per day of $1.50. It is seldom recognized how important savings in wheel costs become, since they are repetitive, applying throughout the life of the tool. We have known situations where 360 cycle was installed solely on the basis of wheel savings.

ACTUAL POWER COST

To determine actual power cost, a case history involving 41 tools was used with 45% factor of use. This showed 6.7¢ power cost per hour, or 53.6¢ per day per tool, for the air tools. Cost of the 360-cycle tools, using 0.015 kilowatt-hour cost rate, was, 1.95¢/hr or 15.6¢/-day. The difference between the two figures is saving of 38¢ per day, per tool, for the net realized power savings. In averaging a variety of case histories, the average savings in power costs in installations with varying number of tools (ranges from 10 to 76 tools) was 72.8%. Of course, expressed in dollars, this is only about 5% of the average labor cost.

COMPARISON OF WEIGHTS

Comparison of weights between the two types should not be made on the basis of catalog weights, but on the basis of the working weight of the tool, equipped with wheels, guards, air hose, or cable. For example, a heavy-duty air grinder catalogs at 11.8 lb; corresponding 360-cycle tool is 14.5 lb. However, when both tools are properly equipped they weigh exactly the same amount: 19.1 lb. Past prejudice in this respect is at least partly confirmed in the case of the 180-cycle portable tools, which do weigh more than the heavy-duty air tools. The general feeling, however, that 360-cycle tools are much heavier than air tools is not supported by the facts.

ACTUAL INVESTMENT REQUIRED

To show the comparative investment for various new installations of high-cycle and air tools, complete with power supply, several sizes of installation are charted. Referring to one specific example, the cost of 41 air tools was $9,695.00. The cost of the necessary

air compressor with controller, intercooler, air receiver, and aftercooler was $24,538.00, making a total cost for the air installation of $34,233.00

The cost of the corresponding 360-cycle unit was $9,910.00 for tools and $9,174.00 for a 50-kw motor-generator (62.5-kva, 360-cycle, 220-volt, 3-phase, including starter, plugs, and receptacles). The total cost of the high-cycle unit was $19,084.00, a substantial savings as compared to the cost of the equivalent air unit—$34,233.00. Over broad ranges of installation sizes it will be found that the cost of high-cycle and air tools themselves are practically the same, but the cost of the motor-generator for running an equivalent number of tools (in the range of 20 to 76 tools) will be 61.7% less than the cost of the corresponding air compressor, a substantial saving in investment cost. If we compare the complete cost of installation of tools and power supply in this same range of 20 to 76 tools, the cost of the complete high-cycle installation will average 46.4% less than the corresponding cost of the air installation.

WHERE 360-CYCLE WORKS BEST

Heavy-duty work, according to test results, is a prime target for application of 360-cycle tools. The exact savings in production time or the exact increase in production will be greatest where heavy-duty abrasive conditions are found. It work falls under the term "medium-duty abrasive conditions" savings will be reduced, as shown in some of the case histories, but will still be substantial.

THE "TIME TO REPAY" MAY BE SHORTER THAN YOU THINK. HERE'S HOW TO FIGURE IT . . .

PRESENT TOOL Air Vertical Grinder TIME REQUIRED PER UNIT 9 MINUTES

H C TOOL 2680VG-5600 rpm 360 cy. R A Grinder TIME REQUIRED PER UNIT 5.5 MINUTES

SAVINGS 3.5 MINUTES

DIVIDE SAVINGS BY PRESENT TIME = 39 % SAVING

HOW MUCH OF TIME IS TOOL USED? 65 % USE

HOW LONG WILL IT TAKE TO PAY FOR THE NEW TOOL?

PRICE OF NEW ROTOR TOOL $325.00 = $325.00

39 % SAVING x 65 % USE x $2.40 HOURLY RATE x 40 HRS. PER WEEK = $24.30

13 1/2 WEEKS TO REPAY THE COST OF NEW ROTOR TOOL

"Time-to-repay" statement shows typical industrial analysis of heavy-duty abrasive-grinding job

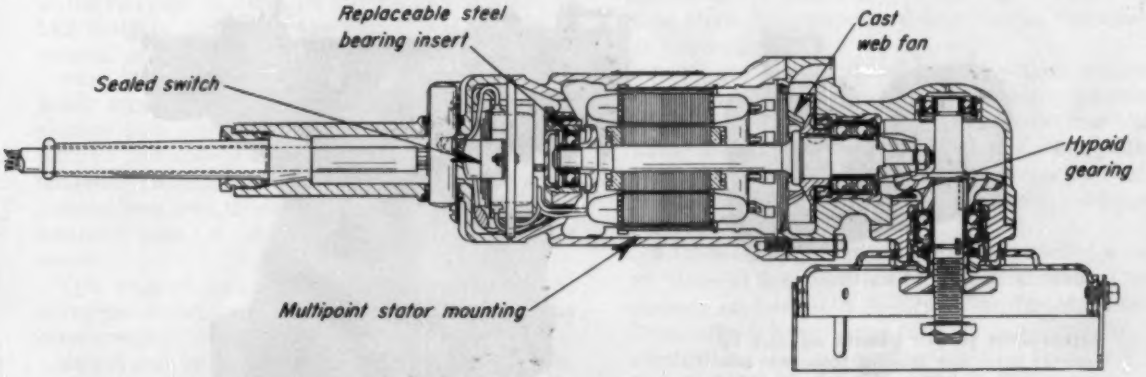
APPLICATION OF 360-CYCLE TOOLS

First general application of 360-cycle tools is to reduce costs while utilizing existing space, at the same time obtaining a short time to repay the investment. Savings per day can be figured by adding (from previous page):

Production saving	$1.90
Wheel saving	1.50
Power saving	0.38
Total	$3.78

In a year of 200 working days, in the case of 41 tools, the savings are $30,996.00. The complete cost of the 41-tool installation, with tools and motor-generator, is $19,-084.00. Dividing this by the savings equals 0.615 years or 7.5

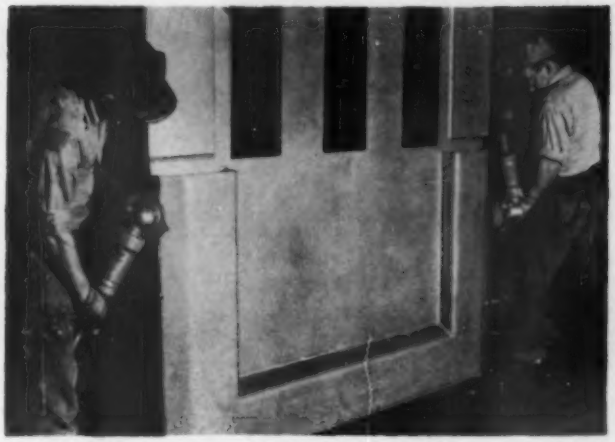
Second application of 360-cycle tools is to increase production within existing space, and at the same time obtaining a short time to repay the investment. The time to repay for increased production will be found to be surprisingly low as compared to adding air capacity; using our previous figures, 41 tools, this can be computed as follows: The value of increased production of 31% with same men per day, per tool, as shown on page 118 is $2.59. Add to this the wheel savings cost of $1.50, power savings cost of 38¢, bringing daily savings per tool to $4.47. Multiplying this by 200 working days gives annual savings of $894.00 per tool, per year. Multiplying this by 41 tools, annual savings are $36,654.00 compared with air tools. The actual purchase price of the 360 cycle



360-cycle angle grinder has hypoid gearing, heavy spindles, and double bearings in replaceable inserts combined with multi-point stator mounting to provide strength and rigidity without adding excessive weight

Vertical turret lathes are available on market in 36-42-62-84

360-CYCLE PORTABLE TOOLS . . .



Case study on medium- and heavy-duty work: press upright is ground with cup wheels. Production time saving is 26.2%; time to repay tool cost is 20 weeks

Case study on heavy-duty work: Welded joints of frame end for alternator are ground with right-angle 360-cycle tool. Time saving over air tools is 39%; time to repay is 13½ weeks

tools and motor generator will be $19,084.00. Dividing this by the annual savings of $36,654.00 the time to repay is 0.52 years or 6.2 months.

The third application is to increase production by adding space such as a new plant, or separate plant additions, at the same time acquiring this production with a minimum of investment cost.

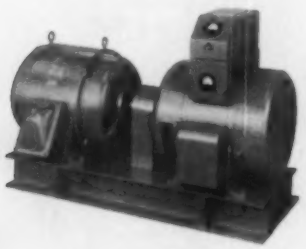
For example, if plant management wants the increased production represented by approximately 30 additional tools, the total cost of the air tools, necessary compressor, etc, as shown in the chart, will be $26,172.00. However, if 360-cycle tools are installed, the total cost will be only $14,352.00, a saving in investment of $10,820.00 or 41%. In addition, the 360-cycle installation, as compared to the air installation when new and operating at high efficiency, will still produce more metal removal and will reduce wheel cost and power cost. In these days of high plant investment, such minimum investment for additional production is attractive and should always be considered.

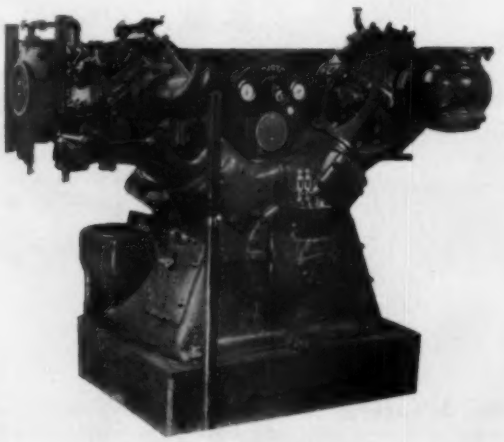
ANALYZING YOUR OWN SITUATION

Each individual situation requires its own analysis, which can be made along the lines suggested above, and a time-to-repay statement computed. The practical way to do this is to borrow a 360-cycle portable motor-generator with a small group of tools from the manufacturer; then the actual times for air and 360 cycle can be ascertained. In all cases, the proper percentage of use must be applied to get practical, realized savings.

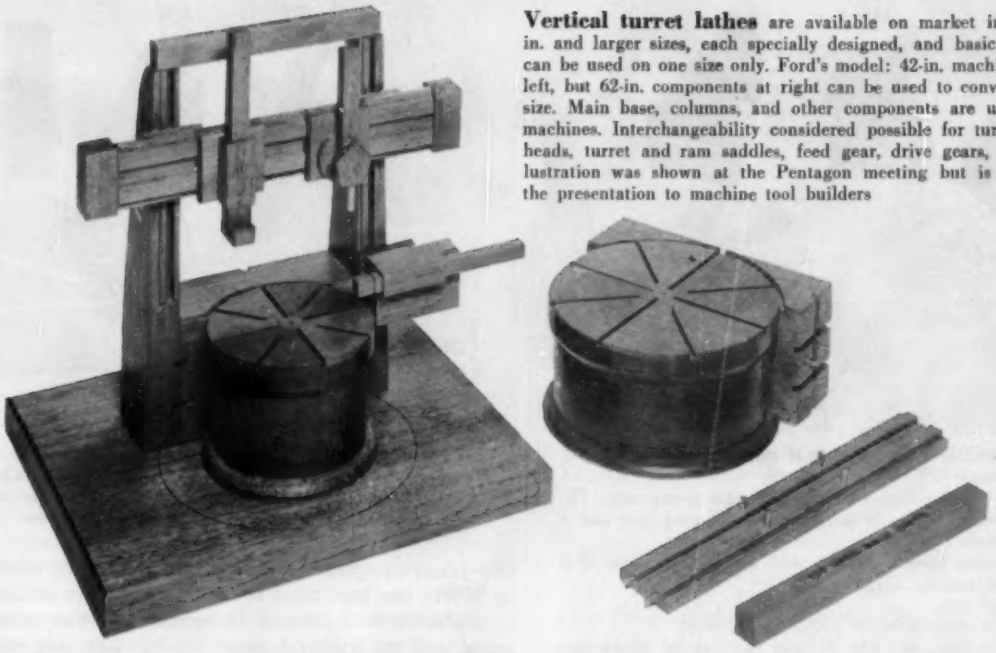
Four case histories shown in this article illustrate, under practical conditions, that the range of savings in time will run from about 17% where work is very light duty, to 40% or more where work is heavy duty. In some cases where the job is a combination of light and medium-duty work, savings will run about 27%.

360-cycle portable tools make sense for heavy-duty abrasive grinding, for the three general applications discussed in this article. With a low investment cost, the tools provide savings that wil' be repetitive over a period of years, and offer a challenge to aggresive factory management.





Equivalent power plants will both operate 24 heavy-duty grinding tools. Air compressor (500 cfm) takes 33.7 sq ft and is 6 ft high; motor-generator set (20 kw) requires 11.5 sq ft and is only 33 in. high



Vertical turret lathes are available on market in 36-42-62-84 in. and larger sizes, each specially designed, and basic components can be used on one size only. Ford's model: 42-in. machine set up at left, but 62-in. components at right can be used to convert to larger size. Main base, columns, and other components are used on both machines. Interchangeability considered possible for turret and ram heads, turret and ram saddles, feed gear, drive gears, etc. This illustration was shown at the Pentagon meeting but is not part of the presentation to machine tool builders

Ford Maps 4-Stage Program for "Building-Block" Machines

General Motors and Chrysler have organized sub-committees to study and develop specifications and standards for building-block construction and standardization of production machines. Object: to win approval of program by builder and user groups under the auspices of the Joint Industry Conference

To spur progress on development of standardized components for "building-block" machine tools,* Ford Motor Company executives are following up their recent Pentagon presentation by starting a round of informal visits to machine tool builders.

Chrysler and General Motors are participating, and International Harvester has shown interest. Purpose of these visits is to get reactions to the idea and suggestions.

In reality, Ford now has reached the third stage in promoting the "building block" concept. The initial step was to stimulate interest among machine tool builders and users; the second was to publish general specifications for in-line transfer machines.

Now Step 3 involves development of more detailed standards for production machines by cooperation with other users and the machine tool industry. Industry-wide dimensional standards for mounting patterns are requested for the basic components required to construct nearly all production machine tools. A standard work height will be sought.

This stage of the program will be continued until a representative cross-section of the industry has been covered.

Step 4 will be the natural outgrowth of Step 3, in that standardization of spindle heights and mounting dimensions will be sought, in order to permit interchange of various makes of power units.

Presumably detailed standards will be worked out under the auspices of the Joint Industry Conference, whereby industry-wide agreements on standardization are achieved by mutual consent.

Before starting to "put the show on the road," Ford had already made a number of moves calculated to stimulate interest, reactions, and results:

1. Top manufacturing executives broached the subject to machine tool builders at the 1955 Machine Tool Show. Reactions were described as "lukewarm to enthusiastic."

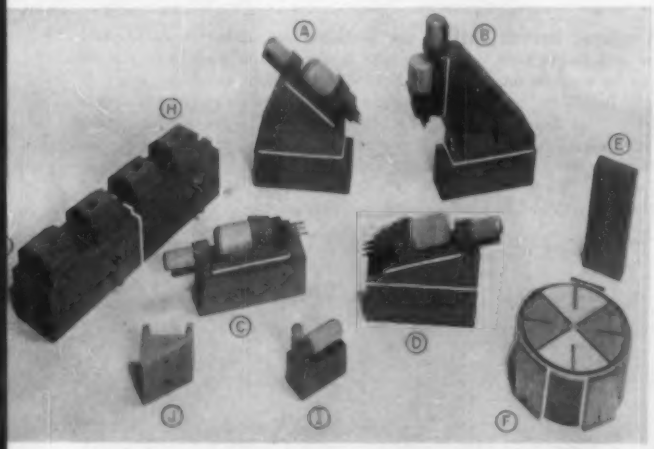
2. Ford's studies of the building-block concept, primarily as related to in-line transfer machines but also mentioning quickly assembled defense tools, were released to *American Machinist*. (Ed. Note—*AM* also sought and published the reactions of a number of people in the machine tool industry—July 16 '56, p168).

3. In seeking quotations, Ford has attached a copy of "General Specifications for Interchangeable Components of Automatic In-Line Transfer Machines." These efforts have borne fruit, as witnessed by the illustrations of equipment installed by Ford for 1958 models (*AM*—Sept 9 '57, p125).

4. Ford made a presentation on "building-block"

*For the first report published on this subject see "Ford Says: 'Let's Have Building-Block Machine Tools'" (*AM*—July 16, '56, p113).

STANDARD WORK HEIGHTS



Interchangeable machine tool components developed by Ford engineers:

A and *B*—vertical columns with demountable power units. The vertical column itself is split into two parts—a wing base and a truncated column.

C and *D*—wing base units, also with power units. Base *D* is a demountable angular adapter.

E—a control unit.

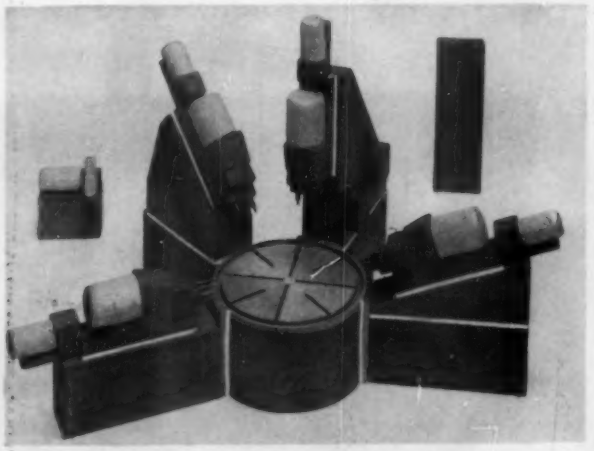
F—a circular table for use on a dial-type machine.

G and *H*—in-line bases with fixtures and transfer mechanisms mounted on them.

I—a hydraulic unit complete with pump and motor.

J—an angular filler block.

The white lines on the major components are parting lines and indicate where these parts can be further broken down into subcomponents



Components in previous illustration have been put together into a dial-type machine. When this assembly is no longer needed, the components could be re-assembled into another machine, even an in-line type

principles on Sept 11, 1957 before a special meeting of the armed services at the Pentagon. Ford speakers were: D C Pippel, manager, Mobilization Planning and Defense Sales Dept, on "Standardized Machine Tools to Speed Mobilization," and H C Daum, manager, Machining Process Dept, Manufacturing Engineering Office, on "Standardized Production Machines."

MACHINE TOOLS AFFECTED

These efforts have so far aroused limited interest and use of the building-block concept. At first, emphasis was laid upon the need for interchangeable components for in-line machines because of huge losses if such equipment must be scrapped for product-model changes. Many leading manufacturers of in-line machines developed standards for interchangeable components related to specific product lines. Later, Ford became increasingly serious about the need for standardization of production-machine components in general, especially in the light of defense mobilization needs. Dial-type production machines, vertical turret lathes, external and internal grinders and milling machines, at least, are presumed suitable types of equipment for standardization of components insofar as locating and attaching means, spindle heights, work height and similar details are concerned.

Ford has emphasized many times, and its associates in the automobile business agree, that no user should or desires to dictate machine design to machine tool builders.

At the Washington meeting, Mr Pippel emphasized that perhaps not more than 5% of existing automotive-plant equipment is convertible to defense needs. In WWII the lead time for reconversion to defense by industry was around 18 months. If war comes again, and the building-block concept has been adequately developed, the Ford executive said industry could reconvert in 6 months.

In elaborating on why Ford is pushing the building-block concept, Mr Pippel said:

"Most machine tools can be broken down into about a half-dozen groups of basic components.

"First, we have the supporting units on which various components are mounted. There is the horizontal group including main bases, wing bases, and index tables. And there is another group which includes the vertical supporting columns.

"Second, we have mounting patterns and devices, including the ways on which the tool components operate.

"Next, there are the control systems.

"Fourth, we have what you might call 'plumbing,' that is, cables, pipes, conduits etc.

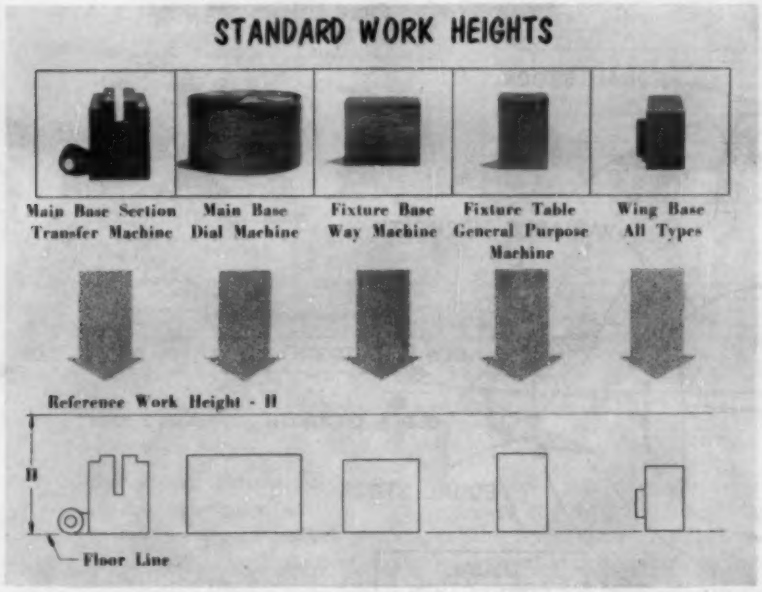
"Fifth, we have the heads and tools, and

"Finally, we have power sources.

COMPONENTS LACK FLEXIBILITY

"Now, the principal trouble with machines built in the past—and with most machines being built today—is that the components lack flexibility. The bases and columns even for machine tools of the same capacity are of different sizes and shapes. Usually this means that working heights are also different. Furthermore, the ways on which the moving parts operate differ in shape and size and this makes it impossible to interchange these operating mechanisms. As a matter of fact, most other components likewise suffer from this same deficiency.

"We figure that if we can standardize the external configurations of these components, we will of course make them interchangeable. They will then be true building-blocks and it will become possible to assemble them in the patterns needed to produce a part for an automobile or a truck or a weapons carrier. If subsequently there is a change in the design of the end-product, the machine used



Ford maps 4-stage program For "Building-Block" machines

Work height is a basic dimension in any machine. To insure the desired interchangeability of production machines that perform special operations, a standard work height from the floor to the loading surfaces of the fixture must be established. All affected components should therefore be designed to conform to this height. The main base sections of transfer machines, the main base or rotary table used in the construction of dial-type machines, the fixture base or table used in assembling way-type and general purpose machines, and the wing bases used with all machines —must all be designed to the same reference height to insure universal interchangeability

to produce it can be disassembled. Components no longer needed can be set aside for possible use elsewhere. If any new or different components are needed, they can be added. Then all the required units can be reassembled in the new configuration and we are in business."

The initial cost of building-block equipment will be higher than that of conventional machines, said Mr Daum, and he unofficially estimated the extra cost at approximately 15%. There is more machining to be done on the components, but even so the interchangeability will be worth the higher cost.

In current talks with machine tool builders, according to Mr Daum, questions to be raised are:

1. Have you developed applicable, tentative, or preliminary standards for your machine components?

2. Do you have jigs and fixtures necessary to produce these standard components for your machines?

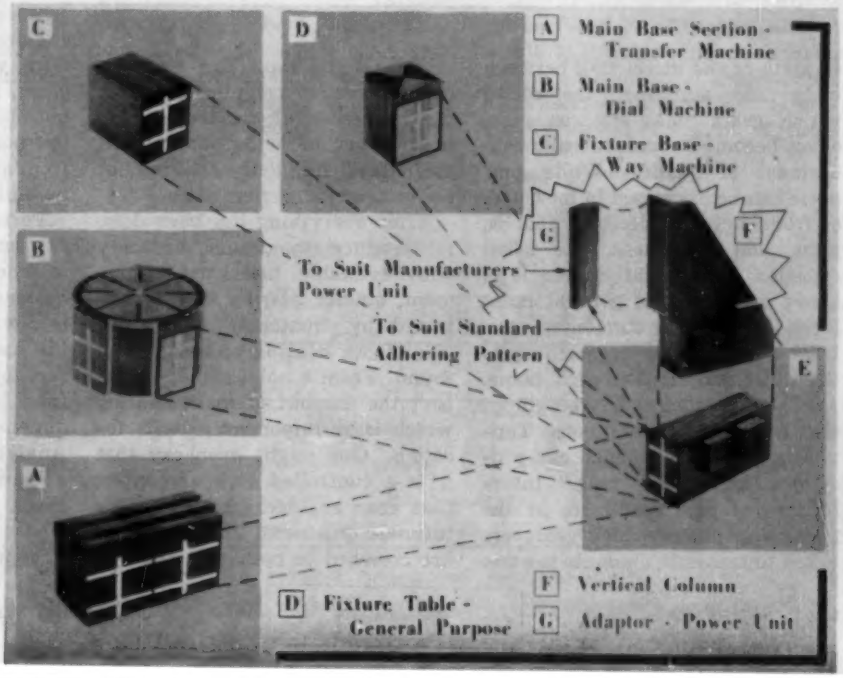
3. How will the adoption of this principle affect existing standards for your machines?

He will add:

"We would like, if possible, to receive interchangeability data on standardized components and units that you have developed, including such items as sizes, configuration and usage on various machines. This information will be tabulated by component and unit grouping so that the various users may develop suggested patterns. These suggested patterns will then be studied to select the sizes and configuration which will fulfill the requirements as set up for the user group.

"The machine builders will be presented with the results of this study together with proposed dimensional standards that will be developed in conjunction with the various user groups."

Standard mounting patterns will be required for such major components as the main-base sections for transfer-type machines, main base for dial-type machines, and fixture base for way-type and general-purpose machines. As shown, components would all have identical mounting patterns and would match with the standard wing base. Other components could be mounted to form the nucleus of in-line, dial, way and general-purpose production machines. The patterns required for mounting these components (such as the vertical column shown at *F*) would be identical to the mounting patterns on the other components, for each size group. One face of the power unit adapter shown at *G* would be machined to a standard mounting pattern, while the opposing face and height would be machined to receive a specific manufacturer's power unit



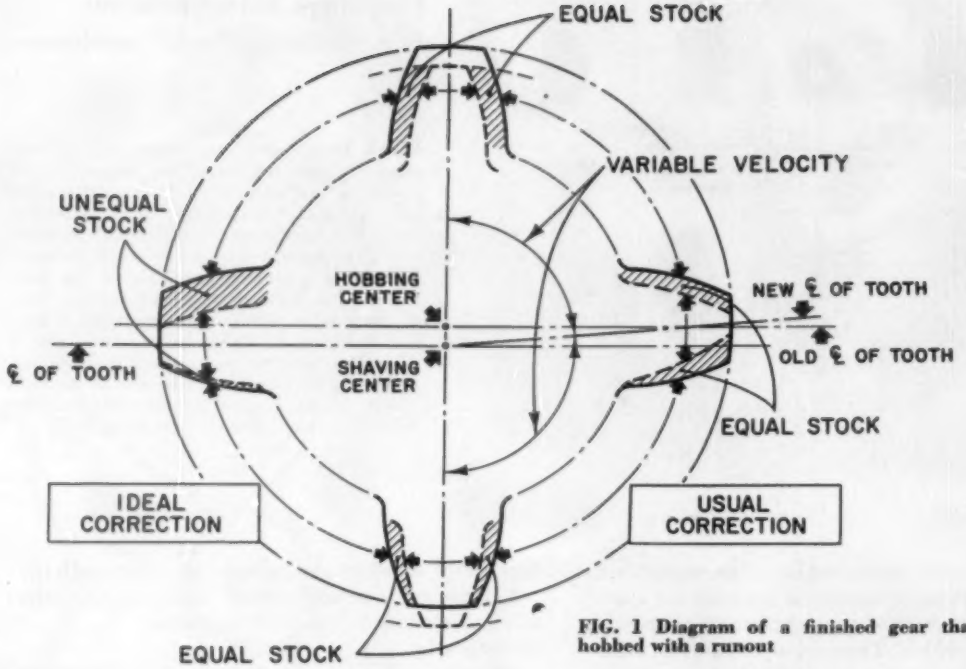


FIG. 1 Diagram of a finished gear that was previously hobbed with a runout

How to cut gear inspection costs

FRED BOHLE, *manager*
Machine Tool Development Department
ILLINOIS TOOL WORKS, CHICAGO

New methods of gear inspection, originally stimulated by the auto industry, offer the chance of better inspection at lower cost to any gear producer whose quantities warrant a master gear. Here is an outline of this more economical approach, as presented at the recent meeting of the American Gear Manufacturers Association

In spite of the direct link between noise and accuracy, the sound which gears make has, as such, never become a standardized measurement of quality. While gear noise can be expressed in measures of frequency and decibels, that is, pitch and loudness, the usual criterion is to what degree it is above or below the general noise level. This background may vary from a noisy shop or machine to the quiet atmosphere of a home.

It should always be recognized that it is easy to make noise. Tapping a gear with a pencil can produce a pronounced "ring." Interference of say, 0.0001 in. at the speed and power which gears are asked to transmit, amounts to more than a pencil tap. The situation may be further complicated when the frequency of the teeth going in and out of action approaches the natural frequency or "ring" of the gear or its carrier.

After everything has been done to produce maximum accuracy with available tools and equipment, quieter gearing may be obtained by "matching" gears for ideal tooth bearing and minimum sound. From a noise standpoint, it isn't the amount of tooth bearing which is so important but its location. One might even say that it is a controlled lack of contact that gear engineers introduce for ultimate quietness. Tooth surfaces are crowned in both the lead and involute direction so that the contact lines come into operation gradually.

The difference between contact and no-contact may be very small indeed. Often 0.0001 in. will achieve the desired result. While engineers know which contact pattern will produce the quietest gears, it becomes very difficult, if not outright impossible, to predict the noise level of a pair of gears from an analytical inspection of its involutes, lead, and spacing.

Fortunately, most gears are not so sensitive that they must be matched and studied for tooth bearing and sound. Sound testing is always an added operation. If the basic design is right, and correct tolerances have been specified, then checking the gears for their dimensional qualities is sufficient. Analytical gear inspection provides a more economical and revealing check because it also indicates where corrections must be made. The problem really is, how to ar-

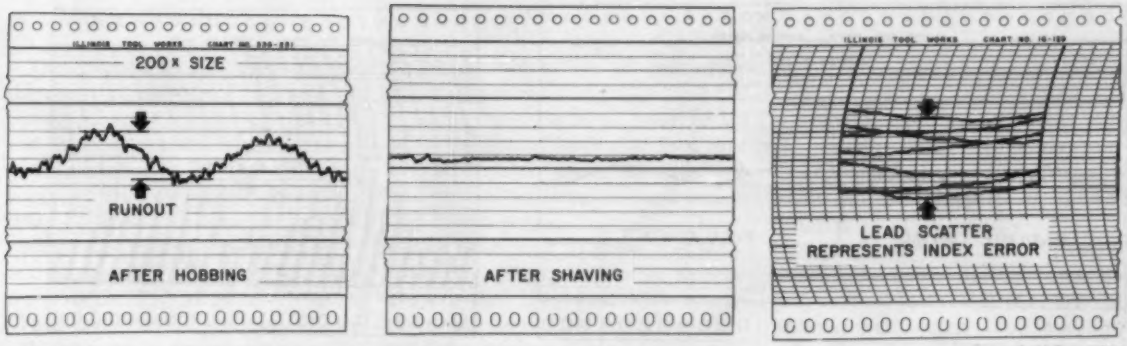


FIG. 2 Charts of lead variation and index error on a shaved pinion previously hobbed with a runout

rive at this dimensional control in an economic way.

Both spur and helical gears are easily and clearly defined mathematically. The gear engineer is a little harder put to specify the modifications which promote quietness and compensate for misalignment and deflections. Finally he has to determine the magniture and nature of the errors he can live with and assign tolerances.

Finally, if it is necessary or advisable to establish tolerances, the gear should be checked to these tolerances. One help in reducing the cost of checking is to be thoroughly familiar with the nature of the various generating processes. Hobbing, particularly when done with single-thread hobs, produces excellently spaced gear teeth. However, the weave of the hob teeth, either inherent or induced by runout, copies itself in the involutes of the gear teeth. Shaping can produce spacing errors, particularly where the end of the finishing cycle meets the beginning. Shaving can hide the runout of the preceding operation. There are strong and weak points inherent in every generating method, and proper inspection should guard against the weak points.

There is one error which is difficult to detect, and therefore many people do not even know about it. The error is of the nature of runout. It has no official name but is sometimes referred to as "hidden runout" or "variable velocity." It is of particular importance on indexing gears and gears working together in a planetary set.

Gear shaving has no gear train between work and tool. It attains its results by the sliding action which is introduced by crossing the axes and by cramping the tool into the work. This produces the well-known improvements in finish, involute, and lead. However, when a gear is brought to the shaving machine which was previously cut, hobbed, or shaped with a runout, that effect is not removed. If the gear is subsequently rolled with a master gear, all apparent runout is gone. The shaving operation was able to remove more stock on one side of the gear than on the other, but if the gear is index-checked, it will be found that at 90° from the original runout position the teeth are as displaced as before. Shaving cannot correct the position of teeth, Fig. 1.

EFFECT OF VARIABLE VELOCITY

As in conventional runout, the angular velocity is different over one half of the gear than it is over the other; thus the name "variable velocity." But there is this difference compared to runout: A gear which rotates about a center other than the one around which it was generated is theoretically not an involute gear anymore. A variable-velocity gear is generated by a mating shaving cutter and will have true involutes about its center. However, they are involutes from a variable base circle. If rotated with a mating gear, and all other things are perfect, a variable-velocity gear will show perfect contact over the entire tooth.

A variable-velocity gear produced by, say a 0.005 difference, is better than a gear of 0.005 runout after mounting. Contact and noise characteristics should be good, because it is doubtful that the low frequency of the velocity change will be audible. In ordinary parallel-axis gearing it will do no harm unless there are high speeds and large masses involved. However, in indexing gear trains or planetary systems, the variable-velocity gear is as bad as one of equivalent runout.

If a variable-velocity gear is checked for involute and lead, it would look as if it had prohibitive errors, particularly if the gear has a low number of teeth. Yet, as previously stated, in spite of these

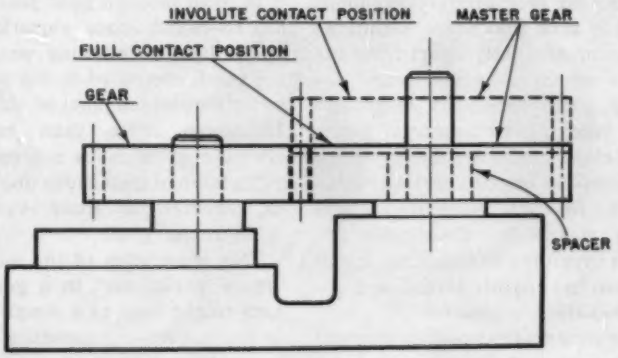


FIG. 3. Involute contact and full contact rolling check

How to cut gear inspection costs...

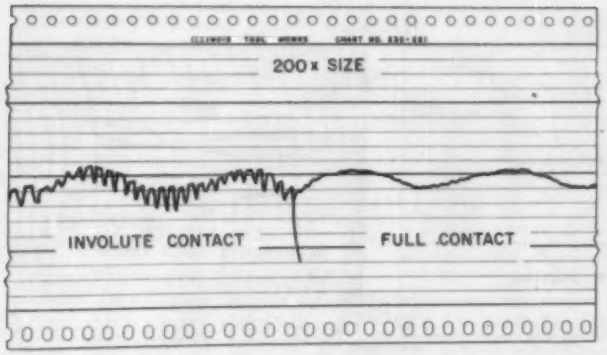


FIG. 4 Sample of an involute and full contact roll chart of the same gear

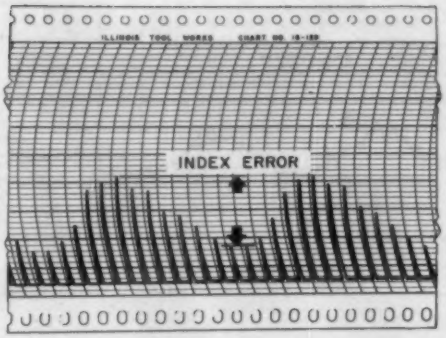


FIG. 6. Chart produced by index checking with an automatic space checker

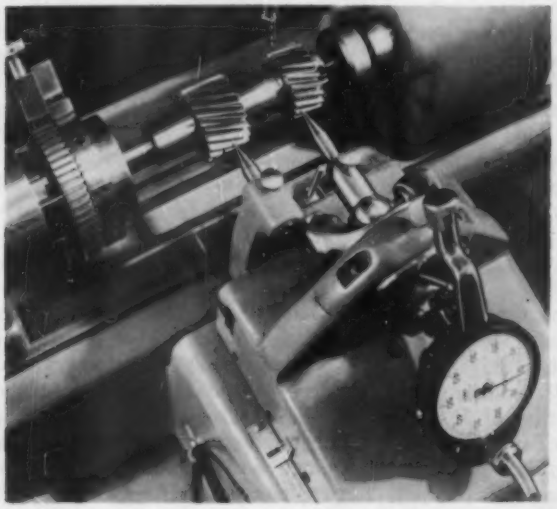


FIG. 5. Lead, involute, and space check performed in one analytical comparator

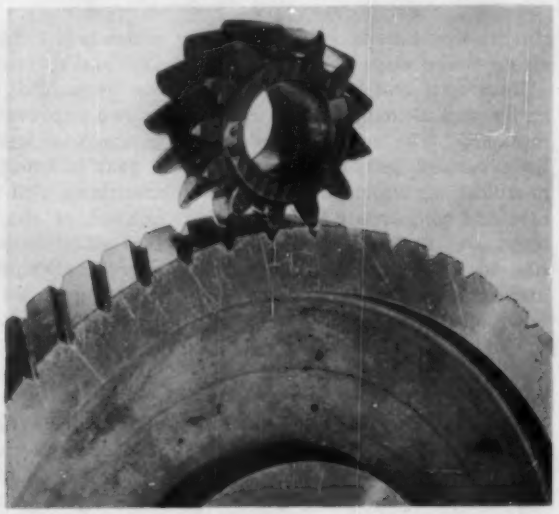


FIG. 7. Lead master contacting a gear near its OD

apparent errors, the gear will have perfect contact with its mate. This, of course, can be reversed by saying that a gear may have substantial apparent errors and yet contact and roll well, Fig. 2.

One other type of gear error is frequently misunderstood. It is the spacing of adjacent gear teeth, or tooth-to-tooth spacing as it is sometimes called.

In actual gear production, about the only time that space variations can occur distinctly apart from involute errors is when gears are milled, shear-speed cut, or ground from index plates or master gears. As a class, these are gears which are form-cut or only partially generated. In these cases it is absolutely correct to distinguish between involutes and spacing, speak of them in separate terms, and assign separate tolerances.

The picture is completely changed if the gear is fully generated, let us say by a single-thread hob. A hob of the correct lead and pressure angle, that is of correct and constant base pitch, cannot make a base-pitch error. Therefore, if the hobbing machine produces an incorrect indexing motion, it must result in involute errors. The base pitch, as produced by the tool, is constant. The same applies to other gear-generating processes.

In most modern gear generators, the so-called space variations induced by the indexing gear train are small compared to the involute variations which must be tolerated. Therefore, more than anything else, the space check represents an expression of gear tooth uniformity as reflected in space variations around the gear.

This realization of the nature of "space variations" in a generated gear might lead to a simplification in the inspection procedure of very accurate gears which receive so-called 100% inspection. An involute and lead check on one tooth, plus a space-variation check, leads to a very good insight into the total accuracy of the gear (*AM*—May 6 '57, p141).

To inspect the dimensional characteristics of gears, that is, those which result in a desirable and controlled amount of contact—or lack of it—it is necessary to do all of the following things:

1. Scan the lead.
2. Scan the involute.
3. Look for uniformity of lead, involute, and spacing on all gear teeth.
4. Check for runout because it is the most persistent and probably the greatest contributor to involute and lead variation.
5. Check for variable velocity if the gears are index or planetary gears.
6. Detect nicks.

This looks like a formidable assignment if one were to think in terms of ordinary lead, involute, and space checking. The universal machines created for these specific purposes are, of course, indispensable in the daily control of the manufacturing processes. However, as a means of final inspection, they are exceedingly expensive; as a screen between the manufacturer and user of gears they may be found to be of coarse mesh. A lot of things can happen between a lead and involute check carried out on a few teeth.

The automotive industry, which produces a tremendous number of quality gears daily, can, of course, not even think in terms of analytical involute and lead checking as a means of final inspection. They have been using the rolling check, using master gears for that purpose. However, since the classical use of master gears is far from foolproof, they have had to back up this functional check with additional sound testing and extensive analytical spot checking. Some have even made the "feel" of an operator's hands a mesaure of quality during the hand rolling check. All this added up to a great deal of expense in which the results were far from gratifying.

It was the needs of the automotive industry which originally stimulated the demand for more foolproof and less costly final inspection methods. As it turned out, these methods are quite simple and straightforward. So much so, as a matter of fact, that they are bound to be of interest to all manufactuers of gears.

These new methods have to do with the use of both standard and special master gears, in standard and special fixtures, in accustomed and novel ways.

The drawback to these methods, aside from the need of a master gear, is that they deal with measurements for which no agreed upon standard or industry-wide understanding exists. However, that situation is also true of the oldest and most common of all checking methods, the standard functional or gear rolling check.

WHAT IS NEEDED

The smoothest, quietest gear would be a helical gear whose contact area is concentrated near the center of all its teeth. A pattern check would show the contact area surrounded by a halo or band of gently fading contact and definite absence of contact near root and OD and near either side. Such contact is obtainable only through uniformly correct and gently crowned involutes and leads.

The ordinary gear rolling check cannot reveal this pattern. While it indicates a definite degree of roughness or smoothness, this effect might be caused solely by the lead-carryover.

Involute contact might be concentrated at a narrow band, near the OD for instance, if the involutes were plus. The same check, however, could be repeated, this time with the master gear positioned to contact only near the face of the gear, Fig. 3. Carry-over is now by involute contact only and, if smooth, would lead to the conclusion now that the involutes must be correct. In both checks the gear made a complete turn to indicate uniformity of all teeth.

Actually, the involute-roll should show a passable pattern and the full-contact roll should show an improvement over the involute-roll. The reliability of this double roll check, Fig. 4, is based on the fact that while hobbing, shaping, shaving, or grinding may produce good and bad involutes, they are at least uniform from one face of the gear to the other. This is a very quick check indeed, performed by one master gear in the same fixture. Recording readily reveals the patterns and the difference of one over the other—and there should be a difference!

In many cases, actually only with the exception of very large gears or fine-pitch gears, there is no reason why the master gear which was used in the dual role described in the preceding paragraphs, could not have been made like the gear which it is to check. If it were, it could not only be used for rolling, but also for a comparison of the involute, spacing, and lead.

Such a comparison check may be carried out in a machine of the type shown in Fig. 5. The table motion parallel to the axis compares lead. The perpendicular motion checks involute or tooth profile. Repeating either involute or lead check on other teeth without

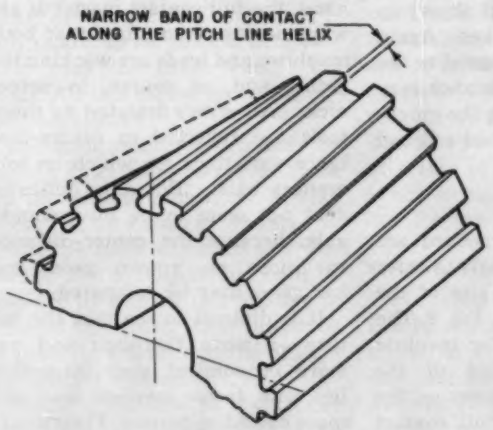


FIG. 8. Helical carry-over master

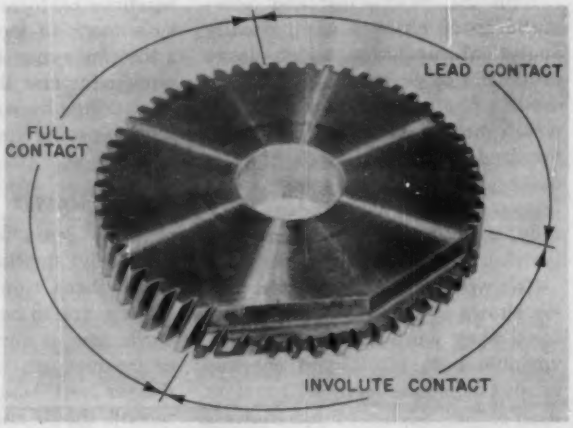


FIG. 9. Three-way master gear

How to cut gear inspection costs...

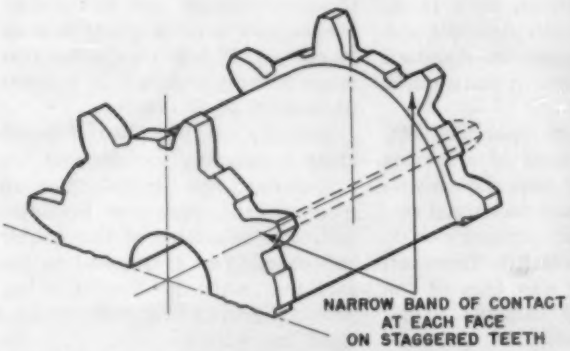


FIG. 10. Master to check straightness and parallelism of spur-gear teeth

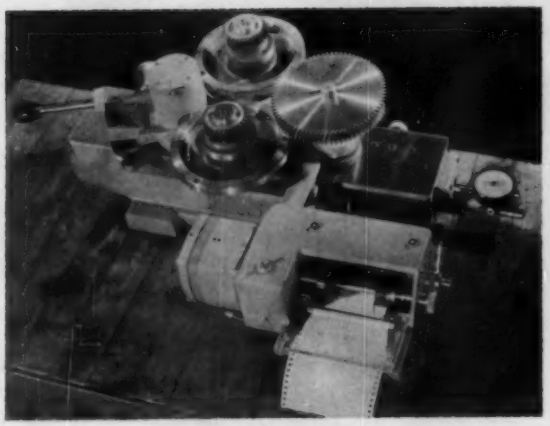


FIG. 11. Two-station rolling fixture with recording

resetting the indicator, checks spacing and index.

This sort of a check is more than a duplicate performance of what is usually done on universal involute and helical lead machines in that it determines the index error which is so difficult to obtain otherwise. If the gear is to be used in an index gear train or a planetary set, index accuracy is all-important. The major contributor to index inaccuracy is, of course, runout.

There is another way to arrive at the scattering of involutes without being side-tracked by the apparent wobble of the leads and involutes. The assembly of master gear and gear-to-be-checked may be put into an automatic space checker where the solid finger has been adjusted to index from the master gear while the indicator finger bears against the tooth flanks of the gear, Fig. 6.

Both the comparator and automatic space checker are basically analytical machines which large producers of gears are reluctant to use in a final inspection department which must pass on the quality of hundreds, if not thousands, of gears daily. For them there is a much faster way to check index accuracy, since their rate of production justifies a special master gear.

The wobbly involutes of the pinion shown in Fig. 1 are present because they were generated from a variable base circle and checked against a master gear of constant base circle. Such a pinion shows a fairly constant tooth thickness at the pitch line but thick and thin teeth near the OD.

Since most gears designed for quiet, high-speed performance are helical gears, a master gear can be designed to contact near the gear OD, Fig. 7. Carry-over from tooth to tooth is by lead which the design of most helical gears permits. Due to the change in tooth thickness near the OD, the master gear will operate at a varying center distance as if the gear had a runout. Tolerances may be assigned to that "runout" and "variable velocity" gears detected.

While near-OD contact lead masters may be advocated for planetary gears, ordinary lead masters would be designed to contact near the pitch line if the gears are helical gears. In that way they scan the lead only, Fig. 8. If lead is off in either the plus or minus direction, due to taper, runout, or machine performance, it shows up as a tooth-to-tooth flicker. Again a tolerance may be assigned to the movement and that tolerance may be obtained by watching the movement on some known good and bad gears.

"TRIPLE" MASTER

If the gears to be checked are relatively small, a single master about three times the size of the work gear can be made, Fig. 9. The work gear is checked for involute carry-over on one-third of the master lead, lead carryover on the second third, and for full contact on the rest. One revolution with this type of master results in a complete scanning of all tooth elements on all gear teeth.

All the previously described special master gears were for helical gears of sufficient helix angle and width to have lead carryover. Actually a master gear, Fig. 10, can scan the straightness and parallelism of spur and low helix gears. Its greatest drawback is lack of experience.

Evidently, by confining involute contact to a narrow band at either face and removing alternate teeth, any wobble, taper or non-parallelism should result in increased tooth-to-tooth flicker.

All these special masters are meant to give a greater insight into the accuracy of gears than is possible with the ordinary full-contact master. Behind an apparently smooth rolling chart can hide a poor contact pattern. On the other hand, the full contact master is always necessary to prove that both involutes and leads are working together and, of course, to detect nicks. All errors detected by these tools are reflected in center-distance variations for which no tolerances exist. But this difficulty does not seem to be insurmountable, because the center-distance variations on known good and bad gears may be compared.

It is difficult to see that the future of more thorough and yet more economical gear inspection lies with faster involute lead and space checking devices. They would have to become considerably faster

FIG. 12. Rolling fixture and limit gage

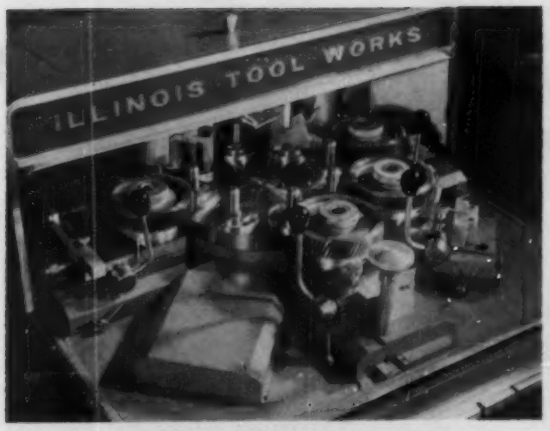


FIG. 13. An automatic gear inspection machine

and more automatic than they now are and, if they were, would probably lose their universal character. There appears to be much more promise in these scanning tools, particularly since they are used in exceedingly simple fixtures.

RECORDING IS NEEDED

The basic device is, of course, the gear rolling fixture, preferably equipped with recording. But here again, just as with the standard and special master gears, a choice is possible and that choice will depend on the number of gears to be checked.

Recording is imperative because the rolling chart is a complex pattern. Runout must be separated from tooth-to-tooth action and there are always the occasional and annoying nicks. In scanning involutes and leads separately from full contact, greater tolerances may be assigned to the first two. In other words, the full contact pattern should never show a deterioration over the other except for nicks. All this makes recording almost mandatory.

The basic rolling fixture may be altered in as many ways as there are production quantities. Fig. 11 shows a two-station fixture in which the other is loaded and unloaded. The arrangement could be reversed by putting two masters in place of the gears. One might be an involute master and the other a full-contact master.

With the addition of a Geneva-motion driven turntable with seven pinions, a machine can obtain charts on all pinions and shut itself off on completion. The operator may accept or reject the gears on the basis of their charts.

The speed of response of recording pens and even indicators is quite limited. Exact figures are difficult to give. They vary not only between makes but according to the size and nature of the errors to be recorded. However, one might think in terms of checking about five teeth per second. This is the limitation of the pen—the moving slide, under proper spring pressure, can respond to much higher frequencies. The upper limit depends, naturally, on the design and mass of the slide but frequencies of 150 teeth per second are in use.

The fixtures which operate at these high checking speeds are still the same rolling fixtures as before in which the indicator has been replaced by a velocity-type pick-up and a small coil and magnet combination. The signal is fed to an oscilloscope, or preferably two: one is tuned to the tooth-to-tooth frequency, the other to the runout frequency. In this way the chart which was obtained by recording at a rate of five teeth per second, is now visible instantly—and without the use of paper.

STILL FASTER METHOD

For shop use, the oscilloscope can be replaced by the mechanism shown in Fig. 12. The rolling fixture and the pick-up are the same as before. The signal is fed to a simple amplifier and red lights over the three stations marked "Runout," "Nicks" and "Tooth-to-Tooth" are set to flash when an error exceeds its tolerance.

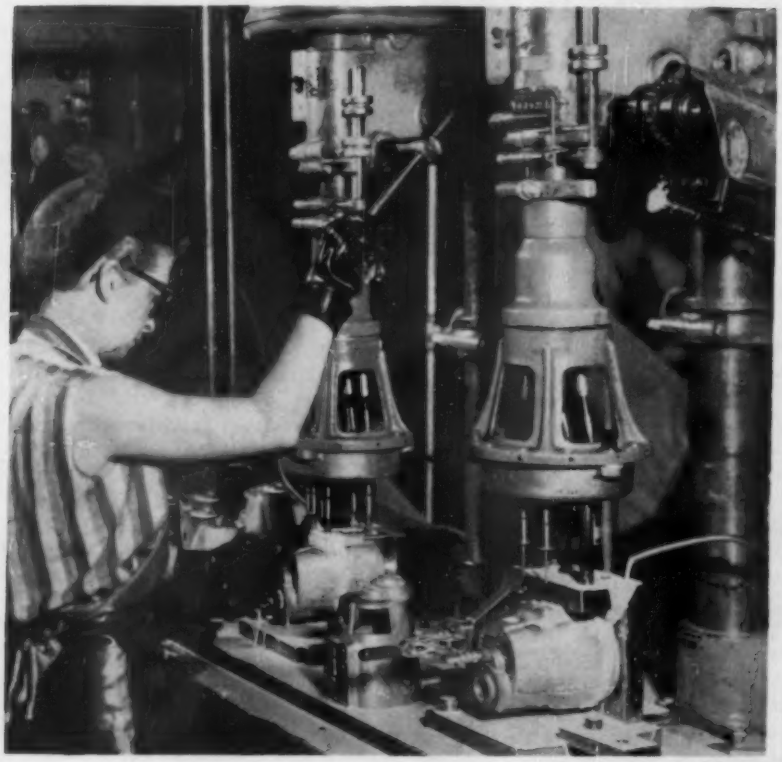
The combination of scanning and full-contact master gears, plus electronics, has made 100% inspection possible at previously unheard-of rates. If quantity really justifies going beyond special masters and single station fixtures, then multiple fixtures may be arranged consecutively around a turntable. Each station has its particular function. In the arrangement in Fig. 13, proceeding from right to left, the first gear is a cleaning gear, the second a full master, the third a helical master, and the fourth a size-checking master. Other machines have been built with additional stations to check the following conditions: tooth-to-tooth, runout, nicks, off-lead, lead variations from plus to minus, variable velocity, taper and size. All these inspections were carried out simultaneously at a rate of 720 gears per hour.

Such machines are only warranted in case of large-scale production. While the stimulus for faster and yet more exacting inspection methods came from these large production plants, it should be remembered that the methods which were evolved are also applicable to much lower production rates. The intelligent use of master gears and special "scanning" masters in rolling fixtures, with the addition of recording or simple electronics, can give better inspection at lower cost at almost any production level.

Multi-Spindle Drillheads

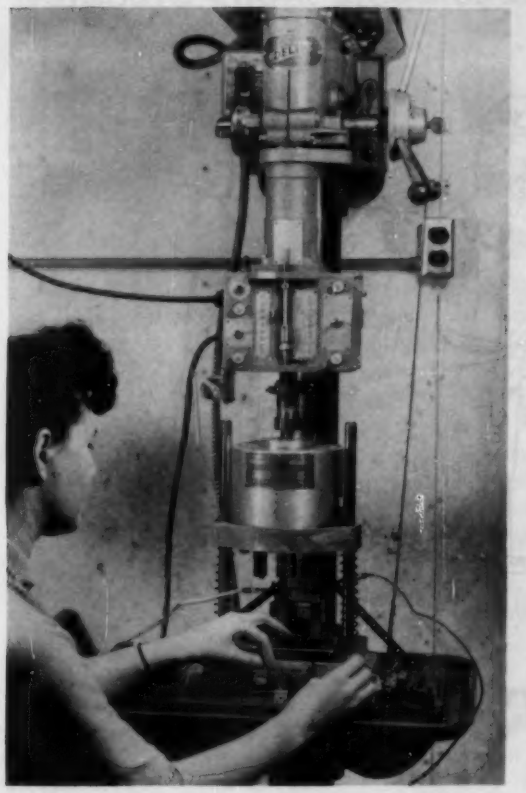
Simple jigs or fixtures and multi-spindle heads can transform a small single-spindle drillpress into a money-making, high-production machine. Where the job and the quantity justify the cost of these units, great savings can be realized—in both large and small shops

Merkle-Karff Gear Co added two Commander multi-spindle heads to these Delta drillpresses to consecutively drill and tap four No. 5-40 holes in small die-cast gear-case housings. Locating fixture holds part under left-hand spindle for drilling; operator places part under hold-down plate below right-hand spindle for tapping. Changeover to different size parts is rapid

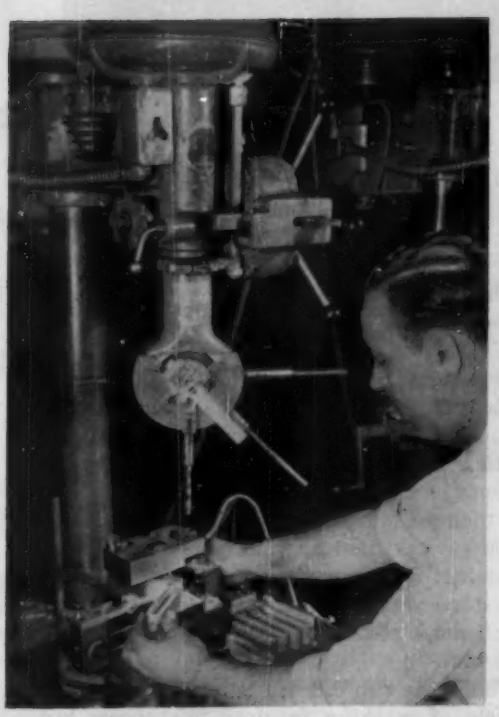


At Portable Electric Tools, Inc, toggle clamp holds die-cast motor end bell under automatic tapping head (right) while operator manually drills one ⅛-in. hole and countersinks four No. 25 holes in next part. Four No. 10-24 taps are kept in line by guide pins which extend up from hold-down bar of tapping fixture into hardened bushings fitted into the Commander adjustable-spindle head. Both heads are fitted to Delta drillpresses

Boost Production

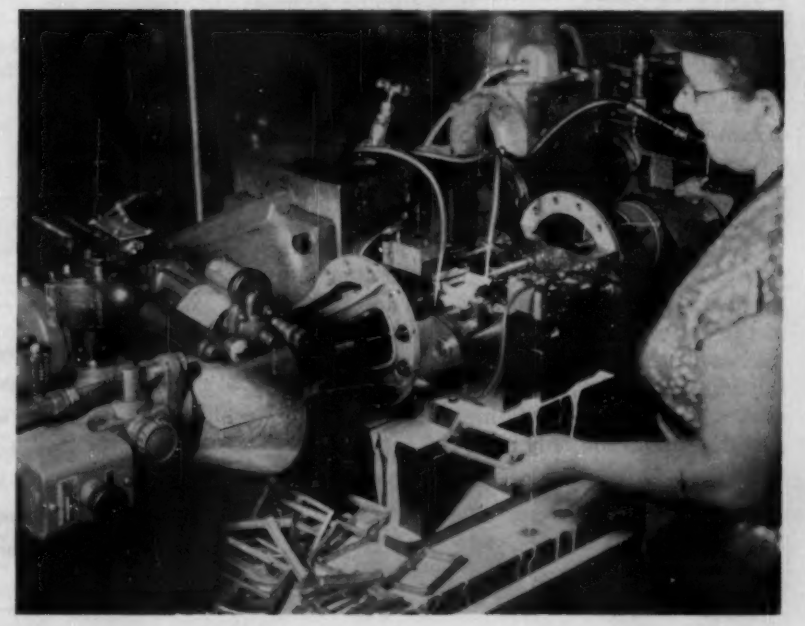


Closely spaced holes are tapped in steel stampings with this setup of a Zagar multi-spindle drillhead and a Commander Lead-Matic Tapper on a single-spindle drillpress. Drillhead is supported by springs on two guide posts, so its weight is not carried by the 40-pitch leadscrew in the upper unit. Spindles in drillhead are arranged for tapping either of two groups of No. 5-40 Class 3 holes—taps being inserted in spindles as required



At the Commander plant, this setup of a Select-A-Spindle 3-spindle head on a Walker-Turner drillpress drills (2000 rpm) and reams (1000 rpm) 7/16-in. holes in ends of locator arms for Multi-Drill heads. Workpiece is held in air-actuated SuPrecision jig bolted to machine table. Spindle speed of the 3-spindle head is changed manually as head is indexed from position to position. Drilling and reaming in same setup insures accuracy of 1½-in.-long holes

Four No. 8-32 holes are tapped in die-cast auto clock frames, two from each side, in this special unit made up of two Model 500 Commander Multi-Drill heads with pitch-compensating spindles. They are mounted on two Walker-Turner drills which are bolted horizontally to opposite faces of a cast-iron block at rear of machine. Air-actuated fixture holds the thin rectangular workpieces during automatic cycle. Guide pins in fixture align heads



Round Table...

Too Careless

"I've got a real problem with Martin, Ed. I don't like to do it, but I think I'll have to demote him."

"That's pretty violent treatment, Al. What's he been doing?"

"Well, twice within a month he's created expensive scrap by taking off too much stock. I warned him the first time, but it didn't do any good. Now I suppose I'll have to do something drastic enough that it will make him pay attention."

"I thought Martin was the shining example you always pointed to when you were talking about just what a good machinist should be. He's done satisfactory work for some years now; I don't see why you should have to demote him."

"That's the rub, Ed. He is a top lathe hand, capable of working to close tolerances; but that's all the more reason I can't let him get away with bad blunders. If I downgrade him one notch and put him on loose-tolerance work, it should make him snap back to his old efficiency, I should think."

"You're going overboard, Al. You have the right to discipline a worker, but as long as he's capable of doing a job, you shouldn't downgrade him. Maybe a few days off work without pay would be more reasonable. If you kick him down a notch, he's liable to decide that it isn't worth the effort to do good work, and it might ruin him completely."

"Well, I've got to either cure him or get rid of him, Ed. He'll get quite a shock if I kick him off high-class work, but at least he'll get the message. A good man is worth some effort, and maybe a little gamble, too."

"Maybe his two mistakes are just a coincidence, Al. He might not make another slip for years. Why don't you give him the benefit of the doubt?"

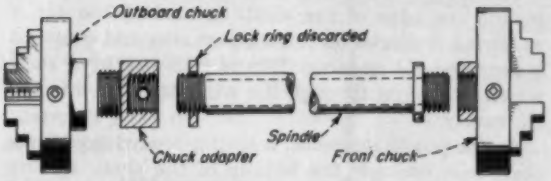
"I can't afford to have any more expensive mistakes, Ed. I've got to do something that makes an impression on him. I think downgrading him is the only answer."

• • •

***SHOULD** a worker be downgraded for carelessness or should a lighter discipline be levied? If a worker is actually capable of good work, but slips once in a while, how can you keep him up to snuff? Your opinions may help others with similar problems. Discussions of earlier topics start on page 201.*

Practical Ideas

Outboard Chuck Steadies Slender Through-Spindle Work



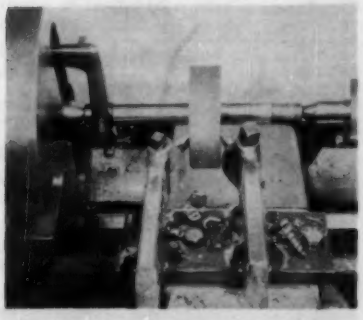
Work protruding through the lathe spindle is difficult to machine at high speed because of the whip at the loose end. Not only does it set up an objectionable rattle but the overhanging end is in great danger of bending.

To remedy this, I have made an adapter for mounting a surplus three-jaw chuck on the back end of the spindle. This adapter replaces the standard locking ring and is left on the spindle even when the chuck is not used.

When turning slender work, which extends through the spindle, just chuck the work as usual, but before starting, run the outboard chuck jaws down on the work. This takes the whip out and reduces the chances of the overhanging stock bending.

There is still another use for the outboard chuck. When I have a run of pieces that must be faced off to identical lengths, the back chuck will hold a piece of bar stock which acts as a stop.

Dan J W Tibbits, Whitefish, Montana



Straddle-Tool Setup Speeds Dual Facing Operation

The illustrated lathe-tool mount was improvised to permit both sides of gear blanks to be simultaneously faced to correct thickness. The arrangement has saved a great deal of time on intermittent runs of this job during the past years.

We had a number of spare toolholders on hand so we simply welded a right and a left offset toolholder to a steel plate, as shown. The plate was secured to the lathe compound by two capscrews threaded into a retainer strip, fitted to the T-slot of the compound. Spacing the toolholders was approximate; final adjustment was made by moving the cutter bits in or outward in the toolholders.

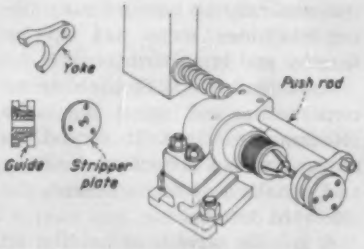
The setup permits work, mounted on a mandrel, to be accurately sized with the advantage of preventing axial slippage through the opposing effect of the two cutting tools. The whole setup is left intact and stored in the tool crib ready for immediate use without further adjustment when the same job is again run.

H J Gerber, Stillwater, Oklahoma

Chip Stripper Cuts Clean-Up Time

We have had considerable difficulty with chips in our 5-spindle automatic. While drilling AMS5643 stainless steel, a tough stringy material, we were confronted with the problem of chips winding around the drill. This compelled the operator to shut the machine down every couple of pieces to clear the drill.

To eliminate this annoyance, and to reduce down time, I devised a chip stripper for the machine.



Though the stripper was designed for a W & S automatic, slight modifications in the basic unit can make it applicable to lathes, drill-presses, or other automatics.

For our unit I use a standard bracket toolholder, No. 177-2555, for the basic mount. A small bore through the bracket carries a push rod in a sliding fit. The forward end of the rod is fitted with a yoke which activates the stripper unit. The other end of the rod holds a return spring which is retained by a bumper knob.

The stripper unit consists of a guide and stripper plate. The guide includes a loose-fitting drill bushing and is externally machined to fit the radius of the yoke. The stripper plate, secured to the guide by flat-head screws, has a central hole filed to the contours of the flutes on the drill to be used. A bumper block, mounted on the actuating slide of the machine, powers the push rod.

John J Phillips, Milford, Conn

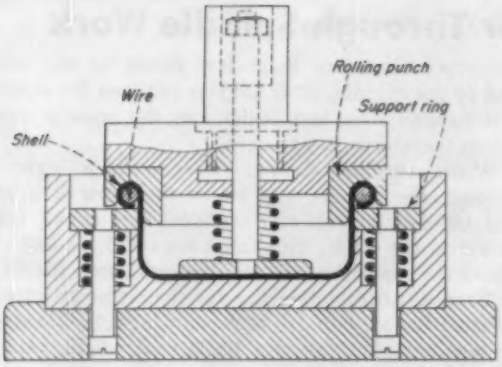
Cola Subs as Penetrating Oil

When a nut is so corroded that it defies removal by any method short of splitting, saturation by cola drink will many times do the trick. Real stubborn cases may need prolonged soaking. This is easily accomplished with a reservoir fashioned out of putty or grease, around the nut and bolt, and filled with cola.

Don't ask me for a scientific answer to this phenomenon; I just know it works.

S Clark, East Bradenton, Fla

Practical Ideas



Die Rolls Wire Into Shell Edge

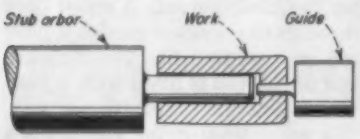
A large quantity of drawn shells had to be edge-rolled. In addition, the edge had to be reinforced with steel wire included in the roll. The simplest and quickest way we knew of accomplishing this was with the one-shot die shown.

The steel wire is precut and rolled to fit snugly around the edge of the shell. In loading the die, a wire ring is placed on the support ring and centered around the die opening. This is followed by a shell which is entered through the wire ring and into the die cavity.

As the punch descends, a spring-loaded holddown plate first contacts the bottom of the shell, forcing it down. The rolling punch follows to roll the edge over the wire. The push simultaneously supports the internal side of the shell.

Stripping the work off the punch is no problem; the holddown plate easily handles that job. A special ejector to remove the shell from the die has not been necessary because the shell does not fit snugly in either die or support ring. However, should one be desired, it can easily be added.

Hjalmar Dahl, Upplands Vasby, Sweden



Model Cement Holds Distorted Part For Grinding

In making a compound die for light-gage washers, whose OD was to be 0.064 in. with a 0.052-in. hole, we encountered difficulty with the tiny inserts through warpage caused by the heat-treatment. Machining had been carefully done to keep all dimensions concentric. Allowances had also been made for grinding the OD and for lapping the die hole.

Yet, after the work was hardened, the stub arbor previously used in machining the OD was too small to hold the part for grinding. A larger-diameter arbor had the tendency to partially straighten the piece with the inevitable spring-back when it was removed from the arbor. Another method eliminating force would therefore have to be devised.

The 0.064-in. die hole was first lapped and a concentric plug made for it. The stub arbor was checked in the lathe and indicated dead true. The small plug was mounted in the tailstock and also indicated. A few drops of model-airplane cement was placed on the arbor and in the counterbore of the workpiece. After the workpiece was mounted on the arbor, the concentric plug was brought forward to engage the die hole.

The work was timed to allow the cement to set overnight. The following morning, the guide plug was withdrawn and the workpiece ground to the finish dimension. An insert with a concentric die hole was the satisfactory result. When the stub arbor was withdrawn, the cement came out with it.

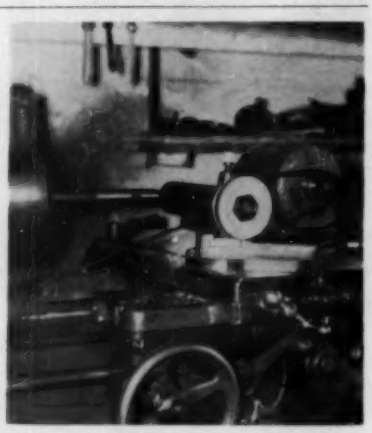
William Fox, West New York, NJ

Attachment Solves Keyway Problem

Pressure was on us to get a number of shafts finished before a certain deadline. Each shaft required a keyway in one end, but production was held up because our milling machines were tied up by lengthy and important jobs.

We solved this little problem by constructing and using the lathe attachment shown. It served its purpose with satisfactory accuracy and, what's just as important, the job went out on time.

A spindle capable of holding an end mill is mounted in tapered roller bearings and housed in a pipe and base weldment. The base is a piece of plate large enough to carry a 1/3 hp motor alongside



the spindle housing. The pipe, which is to be the housing, is welded across one end of the plate.

After the welding is completed, machining is begun by facing off the bottom of the plate. The pipe is next bored out in each end to the OD of the bearings. This must be done in one setup. It's important that proper height, from bottom of base to center of bore, is maintained. It should place the center of the spindle in the center of the work. After the spindle has been assembled in the housing, pulleys are mounted on the motor and spindle. We reduce the speed from the 1750 rpm of the motor to 850 rpm on the spindle. Depth and length of the keyways are controlled by the lathe feeds.

Harry J Miller, Sarasota, Fla

Practical Ideas

HJALMAR DAHL
Upplands Vasby, Sweden

won $25 in addition to regular payment for his idea:

COMPLETE PART IN ONE OPERATION

in the Oct 7, 1957 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

Our annual Production Planbook will reprint all winning ideas as a review. One will be chosen out of this issue as a winner of winners, and will receive a

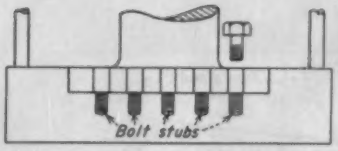
GRAND PRIZE OF $100.

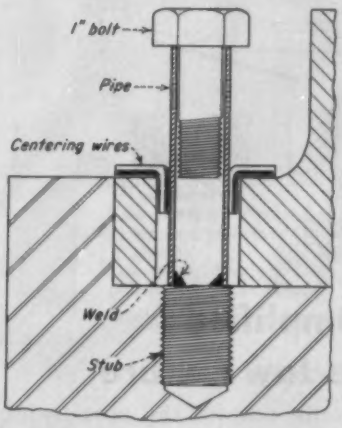
JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N. Y.





Welding Gimmick Extracts Bolt Stubs

As a result of an accident to a 150-ton hydraulic C-frame jogging press, sixteen 1½-in. bolts that held a die head to the flanged end of the piston rod were sheared off. All bolts sheared flush with the top face of the die head. Conventional repair methods for removing the stubs would have required complete dismantling, involving several days' work. Because of heavy work-load commitments, I used the following method and got the press back into service in jig time.

A 10-in. length of 1-in.-ID steel pipe was placed in the holes through the piston flange, allowing the pipe end to rest on the bolt stub. Pieces of wire of the proper diameter were bent at right angles and placed around the pipe to center it in the hole. With a double length of shielded electrode, one of our welders reached down inside the pipe and ran a bead of weld from the bottom inside edge of the pipe to the face of the bolt stub.

A 36-in. pipe wrench was used to unscrew the bolt stub. But before pressure was applied a long 1-in.-dia bolt was dropped into the pipe to keep it from collapsing. After the stub was removed it was cut from the pipe, which was again used on each successive stub with the same procedure. Total time for removing sixteen stubs was 3 hours.

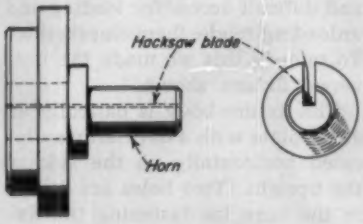
Thomas A Desio, Brooklyn, NY

Chucked Mandrel Stops Chatter

When fairly large-size diameter work has to be turned on a small mandrel, because of the small diameter center hole in the work, difficulty with chatter is usually inevitable when the assembly is machined between centers.

This can be avoided by holding one end of the mandrel in a collet, as close to the work as possible with the outer end of the mandrel supported on the tailstock center. The slightly tapered mandrel does not harm the collet, and proportionately oversized work can be turned on small mandrels with equal success if proper care is exercised.

H Josephs, Gardenville, Fla



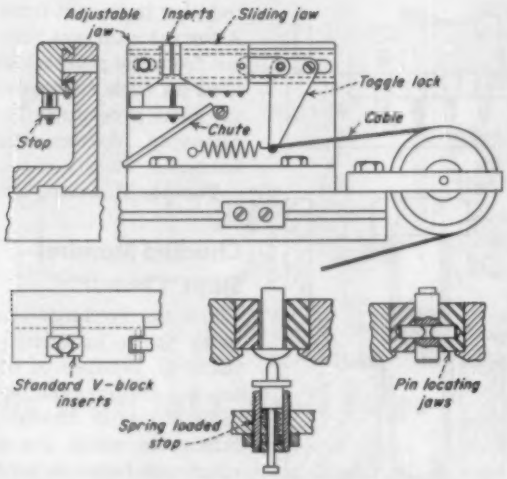
Emergency Broach Shims Made From Hacksaw Blades

When broaching keyways the wear shims sometimes become lost or found worn undersize when needed the most. Should this happen, ordinary hacksaw blades can be substituted until new ones are made available.

These blades are made of fine qaulity steel and hold up well. Many broach operators keep a supply on hand, not only for emergencies but also for running experimental or special short run jobs.

Roger Isetts, Kenosha, Wis

Practical Ideas



Second Operations Simplified With Interchangeable-Jaw Fixture

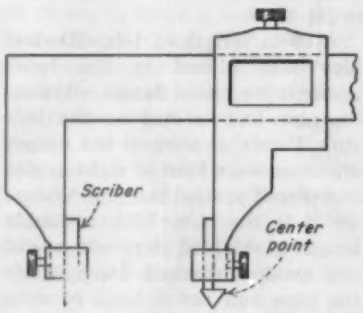
Many of the products from our screw-machine department require a secondary operation. It used to be quite a problem to make economical milling or drilling fixtures for this work on parts of moderate volume. Improvised fixtures and vises were unsatisfactory. Chip accumulation, tedious clamping, and difficult access for loading and unloading made them impractical. To remedy this we made the universal fixture shown.

The fixture body is basically an angle plate with a dovetail way located horizontally on the side of the upright. Two holes are drilled in the bore for fastening the fixture to the milling-machine table. The clamping jaws are mounted on the dovetail way: one is stationary, but adjustable, and the other is a toggle-operated slide. Each jaw is recessed to receive an insert which can either be in V-block form or threaded to hold a screw part.

With a view to making the fixture close automatically, we spring-loaded the toggle lock. The jaws are opened as the table is traversed. One end of a cable is attached to the toggle lever and the other end is guided by a pulley to the knee of the milling machine. The adjustable stop, located directly beneath the jaws, swings out of the way, allowing the finished parts to drop onto a chute which directs them to a receptacle.

Loading the work into the fixture is done with the jaws half closed. This is to facilitate positioning the part and to prevent it from dropping through. A few of the many parts we have handled in this fixture are illustrated. Most of them use the standard stop, while others may use a spring-loaded plunger stop or a pin stop. The nature of the part in each case dictates the type of jaws required.

Tibor Rokay, Santiago, Chile



Points Add to Usefulness of Vernier Calipers

In my line of instrument making, dimensional markings must be accurate because we work within close tolerances. To facilitate the task of layout on parts and templets I made the center and scriber points shown attached to a vernier caliper. It has made hole spacing and radius scribing within 0.001 in. possible.

The scriber point is ground to chisel shape. It's identical to the scriber used in vernier height gages. The center point is machined to the angle desired and equipped with a concentric shank. It is desirable to grind this piece after hardening to insure concentricity. Provisions for holding while grinding should therefore be planned in advance.

The shank is then ground flat on one side. Half of the diameter is removed, placing the flat in dead center with the point. Two clamps are made for securing the points to the calipers. They can be made from solid stock or in sections and riveted together and each equipped with a clamping screw. For durability, good material should be used. Oil-hardening flat tool steel makes a lasting scriber point, while the center point can be made of drill rod.

T W Foden, Mansfield, Notts, England

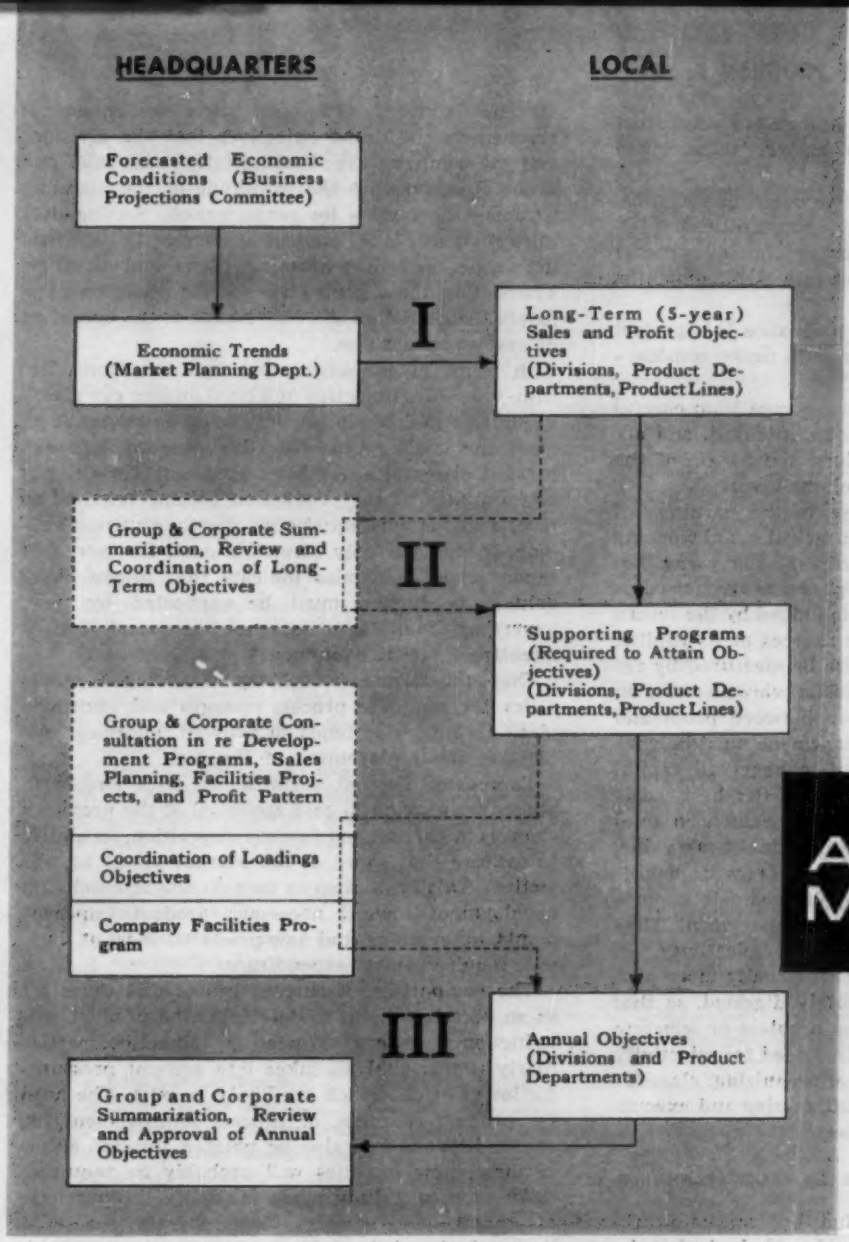
Deodorant Spray Bottle Makes Good Oil Can

A few years ago, while working as a model maker, I stumbled onto the best small oil can for my work. It's a no-spill non-breakable can made from an empty plastic deodorant squeeze bottle.

The conversion is easy; you just unscrew the cap, pry off the inner cap, and pull out the tube. Then you drill out the inner cap and reverse the tube. After filling the bottle with oil, you replace the inner cap and lock the whole thing up with the outer cap, which has also been drilled out to admit the tube.

This improvised can won't break or spill a drop, and it will allow just the right amount of oil to be applied where wanted. It can be used to hold other liquids too.

Robert A Janz, Peru, Ill


HEADQUARTERS
LOCAL
Forecasted Economic Conditions (Business Projections Committee)
Economic Trends (Market Planning Dept.)
I
Long-Term (5-year) Sales and Profit Objectives (Divisions, Product Departments, Product Lines)
Group & Corporate Summarization, Review and Coordination of Long-Term Objectives
II
Supporting Programs (Required to Attain Objectives) (Divisions, Product Departments, Product Lines)
Group & Corporate Consultation in re Development Programs, Sales Planning, Facilities Projects, and Profit Pattern
Coordination of Loadings Objectives
Company Facilities Program
III
Annual Objectives (Divisions and Product Departments)
Group and Corporate Summarization, Review and Approval of Annual Objectives

Planning process... at Westinghouse follows a systematic procedure. Column at left indicates participation of top management; column at right shows responsibilities of product departments or divisions. Solid-line blocks indicate primary or final responsibility; broken-line blocks indicate consulting, advisory, review, and coordination activities. Functions accomplished with this setup are I (basis of planning), II (programs of actions), III (final one-year plan—control of performance)

American Machinist

SPECIAL REPORT NO. 454

December 16, 1957

THE WESTINGHOUSE INVESTMENT PROGRAM:

Planned facilities with built-in profits

W C ALLEN,
director, manufacturing planning,
WESTINGHOUSE ELECTRIC CORP,
PITTSBURGH, PENNA
and
T DALY,
manager, factory planning,
Distribution Transformer Dept,
WESTINGHOUSE ELECTRIC CORP,
SHARON, PENNA

Capital-investment planning demands careful study of all economic factors involved—particularly return on the investment. At Westinghouse Electric Corp., a company-wide Annual Facilities Planning Program has been set up to promote efficient planning. Five-year forecasts, reviewed and up-dated each year, determine product objectives and facility needs. No complex formulas are needed to make this highly flexible program work

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WESTINGHOUSE INVESTMENT PROGRAM . . .

When you plan for new equipment or any other capital investment, can you answer these questions?—

- Is there an orderly way to determine capital-investment requirements and opportunities?
- Will the profit return justify the investment?
- How does the project compare with competing investment opportunities?
- Will funds be available to finance this project along with all other capital projects under consideration?

The answers to these questions come from careful study of all the economic factors involved, and are influenced by two major factors: the nature of the product and the production volume involved.

If a company cannot increase the earnings of stockholder money invested in facilities and working capital, it loses investor favor in the same way that it loses customer favor if its products are not competitive. Because a company is judged by the return on its investments or by the sources of its capital, planning for facilities must also be measured by return on investment. The investor views return on investment as the relationship between profit and net worth, but operating management must be concerned with how effectively it manages all capital under its direction. Consequently, the best yardstick for the operating manager is return on total assets, including fixed assets at original book value.

Capital investments carry advantages or handicaps that will be "locked in" for years to come—often beyond the span of any one management. They normally involve a high degree of selectivity. In an aggressive company, there are usually more proposed projects than can be safely digested, so that management is faced with the problem of selecting the best of many proposals. This need for selectivity demands a systematic means of organizing, classifying, evaluating, and, finally, authorizing and executing capital-expenditure projects.

FACILITIES PLANNING RELATED TO PROFIT PLANNING

If the objectives for a product line can be clearly defined, facility needs can be identified. And if the needs are known, the search for capital projects to take care of these needs will be stimulated and focused. As a result, the first order of importance in capital-expenditure planning is to develop a set of long-term sales and profit objectives for each product line.

These objectives at Westinghouse are based on 5-year forecasts. Every year each of the 33 operating divisions, for each of about 85 different product lines, takes a new fix on the future: what it thinks its market will be five years ahead, the share of this market it feels it can capture, the sales volume that will result, the over-all assets required to support this volume, and the profit-return objective.

These broad objectives are formulated in the spring of the year, when they get quite a going over to determine if they are acceptable objectives. The facilities program, which comes along four or five months later, is developed after agreement is reached on the broad objectives that the divisions and the company are shooting for. These sales and profit objectives are the beginning of the planning process—the targets for performance. Setting definite goals forces an analysis of the market, of product scope, and of marketing plans and strategy. Translating these goals into specific plans requires careful examination of every aspect of the operation of every product line.

In terms of equipment and facilities alone, the fifth-year sales objective of a product line can clearly indicate how much capacity must be increased to meet the goals. And with this capacity gap expressed, the capital facilities needed to close it can be identified. If the production volume required to meet a goal is substantially greater than current volume, it may not only foretell a need for increased capacity, but may also indicate that future high-volume production must be supported by new, lower-cost manufacturing processes (and, consequently, different equipment).

This long-term approach, by indicating opportunities for complete process changes and improved plant layouts, also tends to prevent piecemeal expansion and replacement of facilities.

Comparing current performance with long-term objectives provides a cold appraisal of the product's chances in current and future competition, its ability to capture that share of the market set as an objective. This evaluation in turn directs research and development toward necessary product improvements, innovations, and new products. Most of these will require capital expenditures.

The comparison of current profits and those set as an objective helps to determine the product cost reduction necessary to meet the objective, particularly if this analysis takes into account pressures for lower prices which are likely to exist. The need for product redesign, or process improvement for cost reduction, will also be pointed up; for either of these, new facilities will probably be required.

An economic study made to justify the purchase of equipment is always affected by the nature of the product and the volume of production involved. In many instances, products must be redesigned to suit better methods of manufacture. In automatic assembly, for example, it is often easier to solve troubles—with hopper feeds, automatic brazing, etc—by redesigning the product rather than the equipment or fixtures. Standardizing small parts to increase volume adds to the advantages of mechanized or automated manufacture.

The prime target, economically, is to reduce the *total* cost of manufacturing a part or product, not just to reduce the labor involved or to gain some other short-term goal.

Analyses of technical advancements in machine tools, depreciation status, maintenance costs, down time, and the like are supplementary aids that uncover potentially profitable capital projects. But analyses of the volume increase required to meet a specific volume goal and the cost decrease required

WESTINGHOUSE INVESTMENT PROGRAM . . .

COST & EXPENSE REDUCTION ANALYSIS
WESTINGHOUSE FORM 29136 A

ITEM 1 OF 1 DIVISION X

SUBJECT OF ANALYSIS	DEPT.		
MATERIAL HANDLING IN SECTION C-37	DETAIL MACHINING		
	SECTION	GROUP NO.	COST CENTER
	C-37		

DESCRIPTION OF PRESENT FACILITY

ELECTRIC TRUCKS (6)

AGE	BOOK VALUE
4 YR AVG.	$ 2400

DESCRIPTION OF PROPOSED FACILITY

CONVEYORS TO BE INSTALLED BETWEEN OPERATIONS FOR HANDLING MATERIALS

REASON FOR ANALYSIS

TO REDUCE COSTS AND WORK-IN-PROCESS INVENTORY

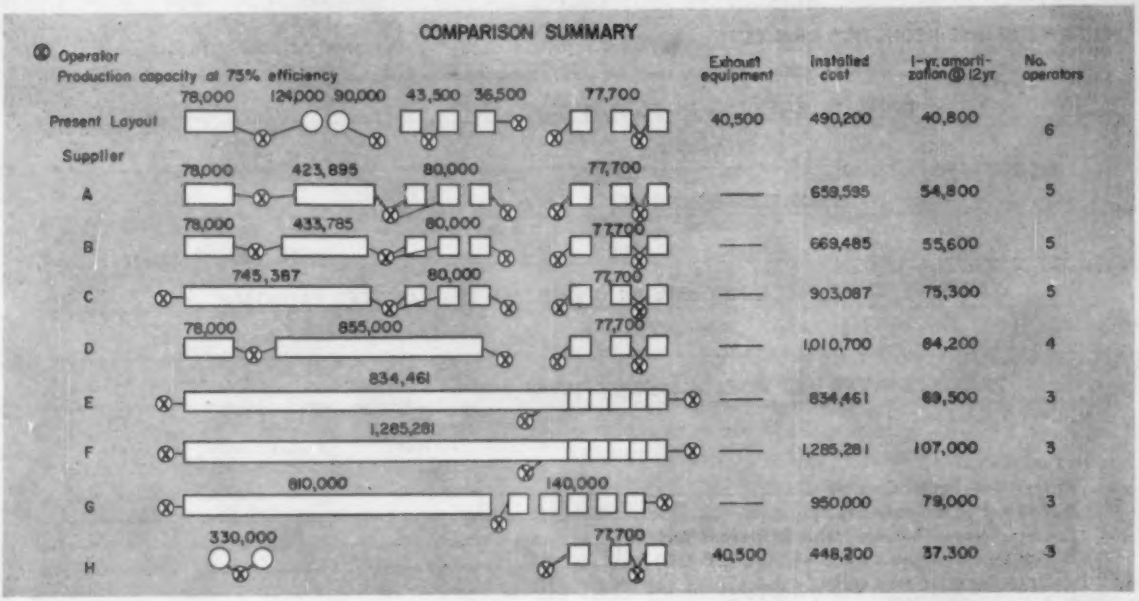
FACILITY VALUES	I PRESENT FACILITIES	II RENOVATION OF PRESENT FACILITIES	III NEW FACILITIES
NET OUTLAY:			
A. Installed Capital Cost (a)			90,000
B. Associated Expense (b)			12,000
C. Less; Present Salvage Value of Present Machine		XXXX	2,000
D. Net Outlay (Algebraic Sum of lines A, B & C)			100,000
BASE FOR AMORTIZING CAPITAL COST:			
E. Salvage Value of Present Machine - One year hence			6 YRS
F. Economic Life		(c)	(d)
G. Installed Capital Cost (same as line A)		+	+ 90,000
H. Present Salvage Value of Present Machine (same as line C)		+	- 2,000
I. Estimated Salvage Value at end of Economic Life		-	- 0
J. Base for Amortizing Capital Cost (Alg. sum of lines G, H, I)			88,000
SAVINGS CALCULATIONS & COMPARISONS - ANNUAL BASIS			
EXPENSE COMPARISON:			
1. Amortization of capital cost	(e)	(f)	14,650 (f)
2. Amortization of associated expense (line B ÷ useful life (g)) 6 YEARS			2,000
3. Cost of maintenance			200
4. Insurance and taxes			200
5. Total (lines 1 thru 4)			17,050
SAVINGS OVER PRESENT FACILITY:			
6. Line 5 comparison (h)			(-)17,050
7. Savings-direct labor			14,000
8. Savings-direct labor-preceding or subsequent operations			
9. Savings-direct labor-premiums			
10. Savings-indirect labor			30,000
11. Savings-defective work			
12. Savings-other than above RESULTING FROM REDUCED INVENTORIES			4,000
13. Expected yearly savings (Algebraic sum of lines 6 thru 12)			30,950
DETERMINATION OF RETURN ON INVESTMENT:			
14. Outlay (same as line D)			100,000
15. Percent Return on Net Outlay (line 13 ÷ 14)			31%

PREPARED BY / DATE	APPROVED BY / DATE	COST OR EXP. REDUCT. DOCKET NO.
JOHN CALWENY	C. A. DUFF	C-37 2027

(a) Estimated capital cost of renovation or new facility, including freight, foundation, and installation.
(b) Associated costs not capitalized, such as rearrangement or auxilary tooling required as a result of this project.
(c) Estimated extension in economic life as result of renovation.
(d) Estimated economic life in consideration of expected technological improvements or product obsolescence.
(e) Present Salvage value (line C) minus Estimated Salvage Value One Year Hence (line E).
(f) Line J divided by economic life (line F).
(g) Useful life of Associated Expense is normally same as Economic life of facility but may differ under certain circumstances.
(h) Line 5 in Column I less line 5 in column II or Column III - may be either a positive or negative figure.

Cost and expense-reduction analysis . . .
is prepared for each facility or new piece of capital equipment requested by a department or division. This form is prepared by Factory Planning personnel (see p143) and is submitted with the appropriation request

WESTINGHOUSE INVESTMENT PROGRAM . . .



Cost comparison . . .
of various lines under consideration to improve a manufacturing line indicates a wide range of differences between suppliers. Quotations for installed cost range from $1,285,281 for a transfer line with three operators by Builder F to $448,200 for rotary machines and honing equipment—also with three operators—by Builder H. Careful planning is needed here

for a specific cost goal may do more than anything to force to light capital-investment opportunities in new, enlarged, or different facilities. In other words, *the real vehicle to profit is the product, not the plant.* Thus facilities planning is only one important part of the over-all profit-planning job. It is likely to be more effective if viewed against the over-all product-line plans.

How the company measures profit performance is also significant in capital-investment planning and control. Where *return on investment* is the basic measure of profit in a product line or operating unit, there is likely to be a greater awareness of the importance of working the assets as hard as possible. This yardstick provides a sort of built-in control that is not in evidence where the sole measure of profits is percentage of profits to sales.

Planning for capital expenditure is actually a combination of manufacturing planning and financial analysis based on the economics of business. *Manufacturing planning* includes every physical asset needed by a manufacturing superintendent to do his job; the *economics of business* include the effect on profits, return on gross assets, and the needs of a competitive position. At Westinghouse, an acceptable return on gross assets that will guarantee the company's objective on earnings per share of common stock per year is one of the guiding rules in a decision to make capital investments.

ORGANIZING THE FACILITIES PROGRAM

Two steps are employed to organize each operating division's proposed facilities program, developed once each year: (1) a five-year projection of capital investment necessary to support fifth-year volume and profit objectives, with major expansion projects (those over $1 million) listed separately; and (2) a detailed program for the next one-year period, with a list of all projects, large and small, to be initiated.

At Westinghouse we have found that two simple but fundamental rules aid us greatly in formulating and subsequently evaluating the program. The first rule is that *expenditures for facilities must be dealt with on a project basis,* identified with a specific product line and aimed at a given purpose. For example, if production bottlenecks in a product line can be eliminated by buying two pieces of equipment, this equipment—together with any rearrangement expenses and associated items, such as conveyors—is considered part of the "project" for making the product line. This project approach emphasizes the purpose of the expenditure rather than the equipment itself.

The second rule is that *every project must be classified according to purpose.* This classification system contains four categories:

1. *Expansion projects:* those intended to provide greater capacity for existing products or for the manufacture of new products. Their justification lies in anticipated increases in sales, profits, and return on investment.

2. *Product-Improvement projects:* those connected with product redesign, quality improvement, or broadening of the line primarily to improve salability. These are justified by an appraisal of the competitive status of the line with respect to the needed improvement.

3. *Cost-Reduction projects:* those intended to re-

duce costs or expenses by the replacement of equipment, by the procurement of different equipment because of product redesign or changes in a process, by manufacturing parts previously purchased from suppliers, or for other similar reasons. Their justification lies in the return to be gained by the projected cost savings on the investment.

4. *Necessity projects:* those that are essential to continued operations but do not fall within any of the other three classes. These are projects required by law or undertaken for reasons of safety, health, or employee relations. Generally they do not lend themselves to an economic evaluation.

Of course, some projects of a broad nature may contain elements of all these categories, but one of these purposes generally predominates. Classifying the projects in this way immediately indicates the information needed to evaluate each project and subsequently justifies it for inclusion in the capital budget. It also permits the division manager—and eventually the corporation management—to see quickly whether or not the proposed program is reasonably balanced among the four categories.

RATING THE PROJECTS

Each division manager presents his projects in the annual facilities budget program, rated in three degrees of preference. For *expansion projects* and *cost-reduction* projects this preference rating is determined by relating the projected earnings or savings to the amount of the investment. A project promising a return on investment of 20% to 30% is rated *C;* 30% to 40% is rated *B,* and over 40% *A.*

Both *product-improvement* and *necessity projects* are rated on the basis of their importance in comparison with rated cost-reduction projects. For instance, a necessity project that might take priority over an *A*-rated cost-reduction project would be an expenditure to correct a serious fire hazard that could jeopardize the earning power of the whole plant. This project would be rated *A.* The rating of these projects indicates whether or not they can be postponed, and to what extent, using as a point of reference the ratings given to projects that can be rated in terms of earnings.

When the programs are presented at headquarters, they are screened thoroughly by group general managers, who represent another level in the organizational strata.

The program is finally taken to the company's top Planning Committee, which often may take exception to some of these ratings. Although the division level is not represented at these meetings, a division's general manager has the right—in fact, is encouraged—to question a low priority assigned an *A* project by the Planning Committee, which may mean its being lopped off the capital-expenditures budget.

There is no formal way of defining different degrees of risk. Consideration to risk is given indirectly in the evaluation of the economic life of the project. In considering the possibility of obsolescence of equipment or of plans that are being projected, the committee must estimate the economic life of that equipment, which in turn demands an estimate of how long the product is going to be good. The machine may last 20 years, but the project may be obsolete in four or five years, so that indirectly the risk factor does enter into the economic life of the facilities involved.

It has not been found advisable to set different acceptable rates of return for various kinds of operations. About 20% before taxes is considered the minimum acceptable rate of return across the board. Some divisions, however, are inclined to set their own minimum return high if they are operating in excess of 20%; others that are not doing so well might be happy if they could obtain a 15% return.

SETTING UP THE CAPITAL BUDGET

At Westinghouse a Headquarters Planning Committee has the responsibility of assisting top-line management in planning future growth and development of the company. A large part of the Committee's activities centers around capital-facilities programs and appropriations. It is a function of this committee to review and evaluate the facilities programs proposed by the several operating divisions, and finally to consolidate these programs into a recommended corporate capital-expenditure budget.

In this approach, the operating divisions' proposed programs—organized by project, classified by purpose, and rated by preference—represent, when summarized for the company, what might be called the *demand* for funds.

About the time this demand figure is developed each year, top management, aided by the treasurer's long-term projections of cash receipts and disbursements, arrives at a capital-investment figure which it is willing to commit in the next year. This sum might be called the *supply* of funds. It is fixed in consideration of such factors as projected cash generation in net earnings and depreciation charges, dividend requirements, and debt-retirement plans. However, at this stage in the capital budgeting process the practice is to assume that the supply of funds will be limited only insofar as it can be generated internally.

The fun comes when the irresistible force, represented by the demand, meets the immovable object, represented by the supply. These must be balanced.

The distribution of proposed expenditures among the four classifications of purpose for all the division programs (both individually and collectively) is examined, so that the general direction in which the proposed expenditures are being channeled may be appraised. For example, a program heavily weighted with necessity projects could indicate that cost-reduction or expansion requirements are not receiving proper attention.

Projects in each program are screened and reviewed in detail. Here the preference ratings that have been applied to each project come into use. The projects are arranged in order of their assigned ratings. This means, in effect, that *they are arranged in order of their ability to produce return on invest-*

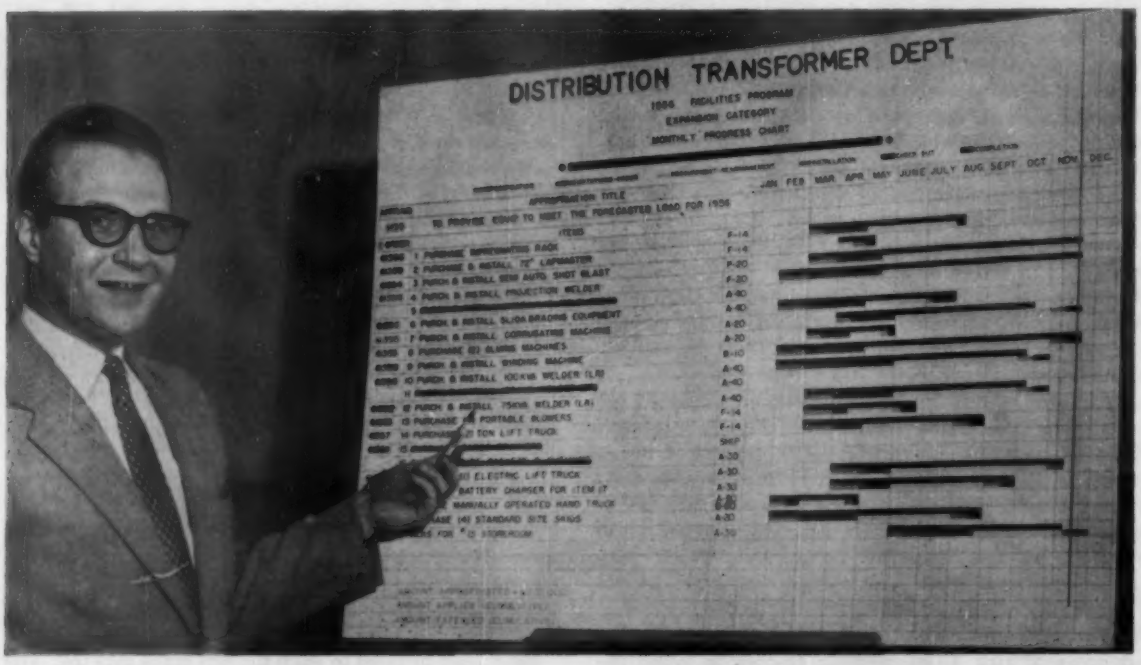
WESTINGHOUSE INVESTMENT PROGRAM . . .

DISTRIBUTION TRANSFORMER DEPT. — 1956 FACILITIES PROGRAM — NECESSITY PROJECTS — MONTHLY PROGRESS CHART

PROJECT TITLE	1956 J	F	M	A	M	J	J	A	S	O	N	D	1957 J	F	M	A	M	J	J	A	S	O	N	D
EQUIP. TO CARRY OUT THE M.C.I. PROGRAM																								
ITEMS																								
EQUIP. TO MAINTAIN PROD. OF TANKS & ASSOC PARTS																								
Beef up herr beading mach																								
Provide tumbleblast & dust coll																								
Provide (2) water wash spray booths																								
Provide (2) 75-ton punch presses																								
Provide (1) vertical double seamer																								
Relocate (2) projection welders																								
Provide wash primer tank																								
Provide calrod heating units																								
Rebuild 60-in. flashwelder																								
Provide (2) projection welders, transformers																								
Provide inert arc hanger bracket welder																								
AMOUNT APPROPRIATED — $243,100																								
EQUIP. TO IMPROVE WORKING CONDITIONS IN D.T.D.																								
Provide storage bins & lockers																								
Provide necessary ventilating equip.																								
Provide (2) water coolers																								
AMOUNT APPROPRIATED — $28,500																								
PROVIDE SPACE & MAT HDLG EQUIP FOR SECS A-40 & 90																								
Provide (1) ton elect. jib crane																								
Mat. Hdlg. equip. for LXT arresters																								
Rearrangement of Sec. T-4																								
Provide misc. equip. for item 3																								
AMOUNT APPROPRIATED — $20,200																								

SPECIFICATIONS — NEGOTIATIONS-ORDERS — PROCUREMENT-REARRANGEMENT

INSTALLATION — CHECK OUT — COMPLETED


DISTRIBUTION TRANSFORMER DEPT
1956 FACILITIES PROGRAM
EXPANSION CATEGORY
MONTHLY PROGRESS CHART
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC

Monthly progress charts . . .
are maintained by a division after facilities are approved and appropriations granted. These show the category to which the facilities belong and provide a close check on their scheduled status. Upper chart is simplified for purposes of reproduction

ment. The cut-off point is automatically determined when the list reaches the total available supply of funds. It may be determined sooner if the return falls below the acceptable minimum, regardless of available funds. Or, on the other hand, if there are projects below the cut-off point which exceed the minimum acceptable return, it may be necessary to re-examine the supply of funds.

Through this process the demand for capital funds and the supply of such funds are balanced, and the resulting list of projects represents the capital budget for the following year.

The inclusion of a project in the capital budget does not constitute authorization for the division to initiate the project. It advises the division that it may proceed with detailed development of the project—architectural work, equipment specifications, etc—in reasonable assurance that the project will be authorized. Each project when ready for initiation must be authorized individually, through approval of a specific appropriation request that completely identifies and presents the supporting information needed for detailed evaluation. Smaller projects receive final approval at the division level. Projects of $100,000 or more must be reviewed through all levels of management and receive final approval only by the Board of Directors.

Follow-up of the profit performance of a particular investment varies according to the importance of the project. But when return on investment is a basic concept of running the business, the operating division manager will think twice before overstating the possibilities of a project.

One of the tests of the effectiveness of this program of controls is the extent to which it taps, through the people in divisional and product-group levels, the maximum potential of capital-expenditure opportunities.

DIVISION ORGANIZATION

The effect of this company-wide Facilities Planning procedure is to promote efficiency and good judgment in the selection of facilities. The various divisions in the company are organized to put the proper emphasis on planning. Manufacturing groups are divided into three basic areas: Operation, Planning, and Control. The Operation group is responsible for production and organization in the shop. Control includes industrial engineering, time study, production scheduling, material control, and quality control. All are under the supervision of the Division Works Manager, including a Planning Manager who directs the Planning group. The idea is to separate day-to-day problems of manufacturing from the pianning function.

Planning in the Westinghouse Transformer Div at Sharon, Penna, is illustrative of the approach taken at the divisional level. (Note: In this division, the Manufacturing Planning Dept is designated Factory Planning Dept, and the manufacturing engineers are called factory engineers.)

Factory Planning in the Distribution Transformer Dept of the Sharon Transformer Div is sub-divided into sections that include Equipment Development, Tool Engineering, Plant Layout and Material Handling, Factory Engineering, and Appropriation and Records. Each of these groups is headed by a supervisor, who reports to the Factory Planning Manager.

The Factory Engineering section of this planning group is located in the shop, and is concerned primarily with initiating the procurement of new equipment to replace obsolete or worn machines. Members keep abreast of new developments and continually study new or modernized machines.

The Factory Engineers write up specifications for new equipment and arrange for bids through the plant purchasing department. In addition, they determine the costs of installation and, if necessary, rearrangement. Then, working with the plant Industrial Engineering group (which is directly responsible to the Works Manager), they make an analysis of the return on the investment. If this estimated return proves favorable, the recommended purchase is submitted, with a request for an appropriation, as part of the annual Facilities Planning Program.

The Equipment Development group has the prime responsibility of designing and developing new manufacturing and product-testing equipment. Their work may be handled in a number of different ways: develop, design and build in the plant, or subcontract one or all of these phases to a firm of specialists. At the Distribution Transformer Dept in Sharon, incidentally, this group may be divided in the future to permit one section to concentrate on manufacturing equipment developments while another designs special test equipment for transformers.

This group's work is a forerunner of the Facilities Planning Program, in that it generates prototype equipment that may become production facilities. But expenses for the development work are borne by a divisional "Standard Development Program," which is not included in the annual appropriation request. This is part of a company-wide program set up annually to expedite development work, and is designed to bear the cost of anything that requires basic design and development. Because the company Facilities Planning Program is set up to take care of equipment procurement, plant construction and rearrangement, and similar projects, the assessed capital value of finished equipment after it is built and put on the production line is borne by the Facilities Program.

The Plant Layout and Materials Handling group —which specifies and procures all conveyor lines, factory trucks, cranes, and hoists—also handles such operations as the layout of new manufacturing lines, structural modifications, and piping and conduit runs. Plant rearrangements for existing equipment and for new machines are their responsibility, too.

Tool Engineering is concerned with the design of dies, jigs, fixtures, and special tools, and has the responsibility for approving all manufacturing and materials-handling equipment from the viewpoint

of plant safety. Of course, this group is responsible for all tooling expenditures and for making recommendations for procuring such equipment.

These four groups provide the Appropriations and Records group with data on their recommendations, so that a detailed request can be prepared for presentation to corporation headquarters under the annual Facilities Planning Program. These data include the percent return expected, the total expenditure, and the expenditure required for each item. Since some projects may require several years to fulfill, the anticipated length of time required is expressed, too. Another function of this group is to follow up and control expenditures of the other four groups, keeping them within the confines of the amounts appropriated.

MONTHLY PROGRESS CHARTS

At Sharon, to control the progress of items approved under the Facilities Planning Program, project time schedules are set up in advance, and Monthly Progress Charts (see p142) are prepared and posted by the Appropriations and Records group. These show the approved equipment to be developed or procured under each of the four categories: expansion, product-improvement, cost-reduction, or necessity projects.

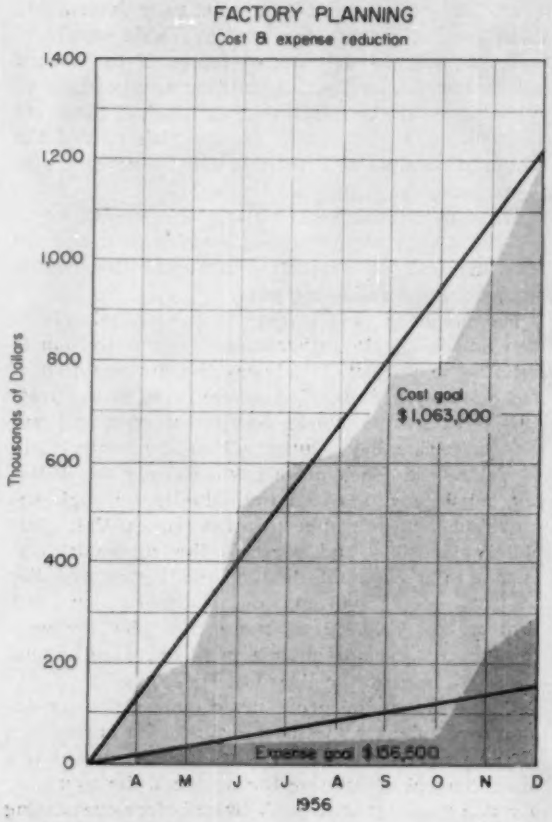
Color-coded bands show the schedule for each project, including time needed to write specifications, time expected for negotiations with suppliers, time needed for delivery and rearrangement, time for installation, and time needed to check out the equipment and release it to production. A running strip, extended each month, shows the status of each project. All groups submit monthly reports to the Factory Planning Manager, showing their procurement, installation, and check-out schedules.

There is nothing rigid about the system. Where later developments reveal that a project is not needed, it can be dropped; conversely, a new one can be added if unforeseen developments arise. In such instances, revisions in the program are authorized.

In addition to these charts, every department in the plant has an Annual Cost and Expense-Reduction Goal chart that is also posted monthly. These charts establish a target amount that design, equipment, and methods should save in one year. Staff meetings, held monthly with a cost analyst assigned to the Factory Planning Manager, show exactly where the Program stands on cost reduction.

At the Sharon division, nothing from the Facilities Planning Program is put into the cost-reduction category unless it promises a 30% per year return, every year, on the investment. All groups under Factory Planning, of course, contribute to cost-reduction planning. To be considered in this category, a project must definitely contribute to the reduction in the cost of the product. For example, a new process that improves the product might also reduce rejects and would thereby qualify.

Under this system, every division in the Corporation applies for protected funds to cover its probable needs every year. Changes can be made as needed in this completely flexible program, for the most urgent needs show up quickly and can be taken care of immediately. The Corporation budget is protected; no funds are expended without the most careful consideration of both the company's competitive position and the needs of each division.



Divisional goals . . .
for cost and expense reduction relative to the Annual Facilities Planning Program are indicated on charts like this. Chart shows how much equipment in the cost-reduction category should save the Division in one year

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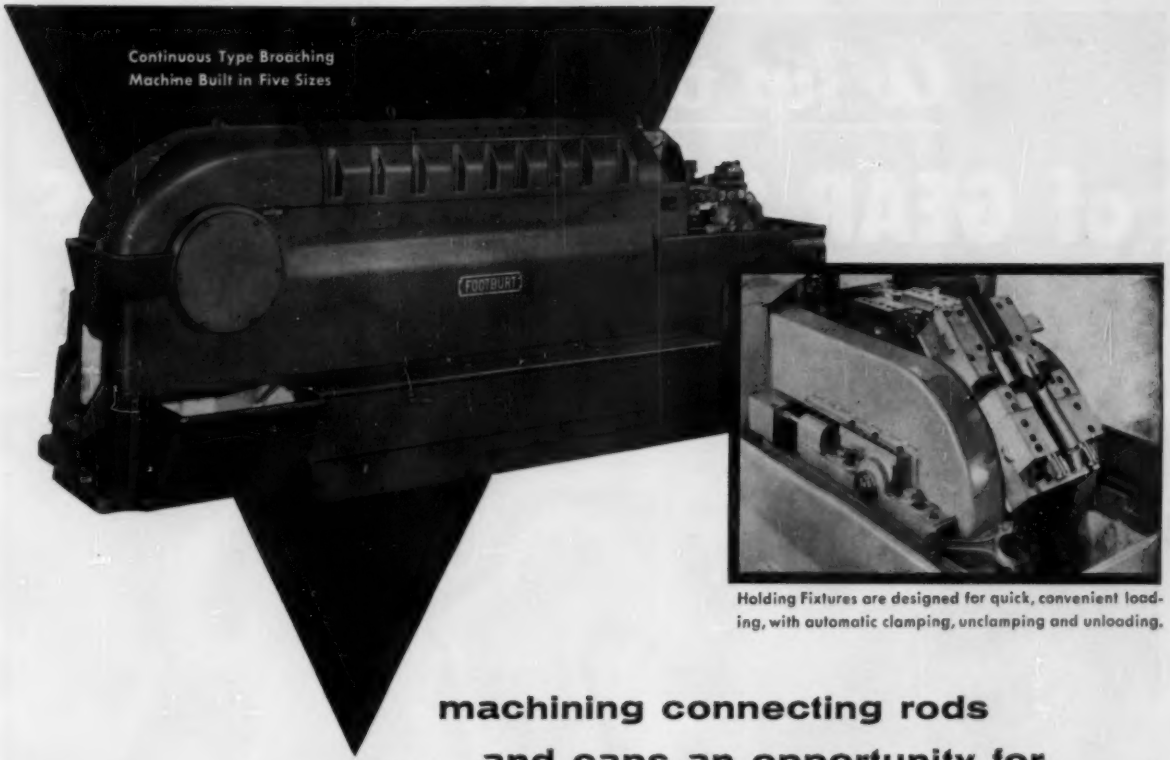

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Forming Data for Part Details . . I

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Standard Joggle

Tight Joggle

FORMULAS:

For Standard Joggle—

$$L = 2.75\,J + 0.35\,R + 0.17\,T$$

For Tight Joggle—

$$L = \sqrt{J \times (4R + 2T - J)}$$

DIMENSIONS FOR JOGGLES

Joggle Length *L* (to nearest 0.03 in.) Applicable to Titanium AMS 4901 and AMS 4908.
For *R*, see table "Design Bend Radii," page 151

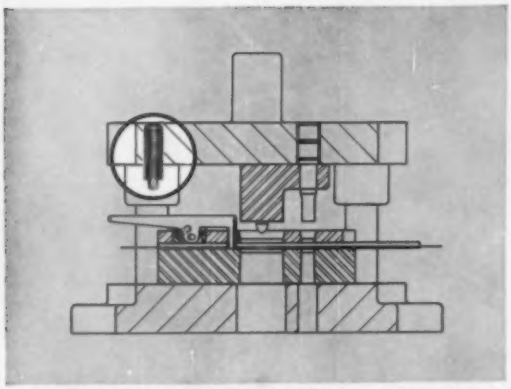
Gage *T*	Joggle Depth *J*** 0.020*	0.025*	0.032	0.040	0.051	0.064	0.072	0.081	0.091	0.102	0.125	0.156	0.188	0.250	0.312
STANDARD JOGGLES															
0.012	0.09	0.09	0.12	0.12	0.15	0.21	0.21	0.24	0.27	0.30	0.36	0.45	0.54	0.72	0.87
0.15	0.09	0.09	0.12	0.12	0.15	0.21	0.21	0.24	0.27	0.30	0.36	0.45	0.54	0.72	0.87
0.20	0.09	0.09	0.12	0.12	0.15	0.21	0.21	0.24	0.27	0.30	0.36	0.45	0.54	0.72	0.87
0.025	0.09	0.12	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.39	0.48	0.54	0.72	0.90
0.032	0.09	0.12	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.39	0.48	0.54	0.72	0.90
0.040	0.09	0.12	0.15	0.15	0.18	0.24	0.24	0.27	0.30	0.33	0.39	0.48	0.57	0.75	0.90
0.051	0.12	0.120	0.15	0.15	0.18	0.24	0.24	0.27	0.30	0.33	0.39	0.48	0.57	0.75	0.90
0.064	0.12	0.15	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.42	0.51	0.57	0.75	0.93
0.072	0.12	0.15	0.18	0.18	0.21	0.27	0.27	0.30	0.33	0.36	0.42	0.51	0.60	0.78	0.96
0.081	0.15	0.15	0.18	0.21	0.24	0.27	0.30	0.30	0.33	0.36	0.42	0.51	0.60	0.78	0.96
0.091	0.15	0.18	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.45	0.54	0.63	0.78	0.96
0.102	0.15	0.18	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.45	0.54	0.63	0.78	0.96
0.125	0.18	0.21	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.48	0.57	0.66	0.81	0.99
0.156	0.21	0.24	0.27	0.27	0.30	0.36	0.36	0.39	0.42	0.45	0.51	0.60	0.69	0.87	1.02
0.187	0.24	0.27	0.27	0.30	0.33	0.36	0.39	0.42	0.45	0.48	0.54	0.63	0.72	0.90	1.05
TIGHT JOGGLES															
0.012	—	0.09	0.09	0.09	0.09	0.12	0.12	0.12	0.12	0.12	0.12	—	—	—	—
0.015	—	0.09	0.09	0.09	0.12	0.12	0.12	0.12	0.12	0.12	0.15	—	—	—	—
0.020	—	0.09	0.09	0.09	0.12	0.12	0.12	0.12	0.12	0.15	0.15	—	—	—	—
0.025	—	0.09	0.12	0.12	0.15	0.15	0.15	0.15	0.18	0.18	0.18	0.21	0.21	—	—
0.032	—	0.09	0.12	0.12	0.15	0.15	0.15	0.18	0.18	0.18	0.18	0.21	0.21	—	—
0.040	—	0.12	0.12	0.15	0.15	0.18	0.18	0.21	0.21	0.21	0.24	0.24	0.27	0.27	—
0.051	—	0.12	0.12	0.15	0.18	0.18	0.18	0.21	0.21	0.21	0.24	0.27	0.27	0.27	—
0.064	—	0.15	0.15	0.18	0.18	0.21	0.21	0.24	0.24	0.27	0.27	0.30	0.33	0.36	0.39
0.072	—	0.15	0.15	0.18	0.21	0.24	0.24	0.27	0.27	0.30	0.30	0.33	0.36	0.39	0.42
0.081	—	0.15	0.18	0.21	0.24	0.24	0.27	0.27	0.30	0.30	0.33	0.36	0.39	0.45	0.48
0.091	—	0.18	0.18	0.21	0.24	0.27	0.27	0.30	0.33	0.33	0.36	0.39	0.42	0.48	0.51
0.102	—	0.18	0.18	0.21	0.24	0.27	0.30	0.30	0.33	0.33	0.36	0.39	0.45	0.48	0.54
0.125	—	0.18	0.21	0.24	0.27	0.30	0.33	0.33	0.36	0.39	0.42	0.45	0.51	0.57	0.60
0.156	—	0.21	0.24	0.27	0.30	0.36	0.36	0.39	0.42	0.42	0.48	0.54	0.57	0.66	0.72
0.187	—	0.24	0.27	0.30	0.33	0.39	0.39	0.42	0.45	0.48	0.51	0.57	0.63	0.72	0.78

NOTES:
**Sheet stock is not to be joggled 0.025 in. or less, except where a smooth surface is required for aerodynamic reasons, or to prevent interference.*
***Add 0.03 in. to J when seam-sealing impregnated fabric is used.*

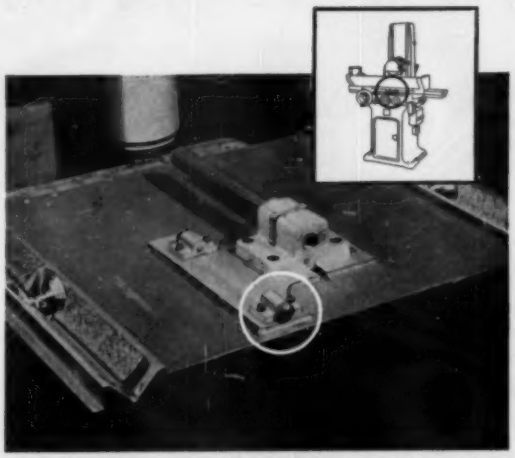
Practical Tooling Tips

Number 2 of a series.

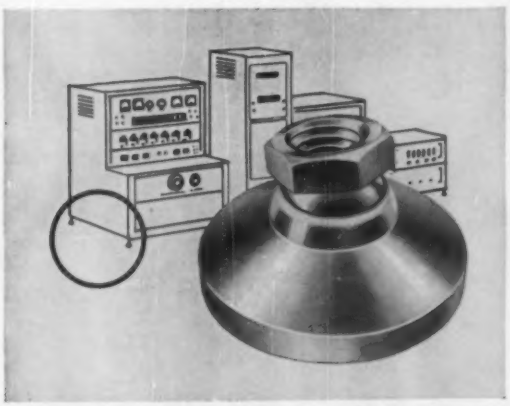
Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.



TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the *standard* Vlier leveling pad. The pad swivels to 7½° each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

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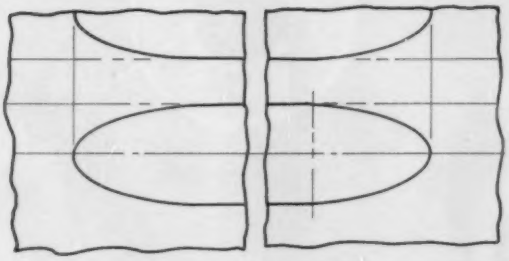
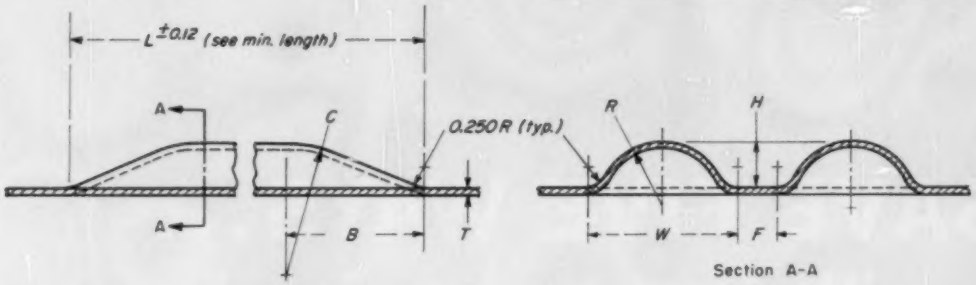
Forming Data for Part Details . . II

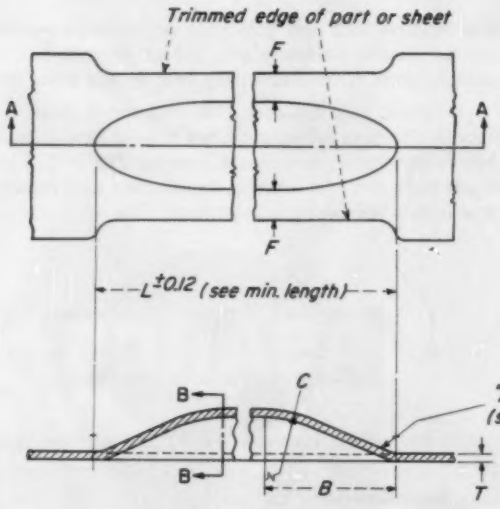


Dimensions of Multiple Beads in Titanium

T	B	C	R (approx)	W	H +0.00 −0.06	L Min.	F Min.
0.025 to 0.051	1.26	1.12	0.94	1.90	0.38	2.75	0.50
" "	1.68	1.50	1.56	2.50	0.50	3.75	0.50
" "	2.30	2.00	2.32	3.50	0.70	5.00	0.50
" "	2.92	2.52	3.00	4.40	0.88	6.25	0.50
" "	3.62	3.00	3.82	5.60	1.12	7.50	0.50

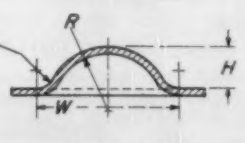


These beads may be formed in: Titanium alloy, RE – T – 41, Titanium-pure, AMS 4901, hot or cold.
Titanium alloy, RE – T – 32, cold only



Dimensions of Single Beads in Titanium

T	B	C Rad.	R (approx.)	W	H +0.00 −0.06	L Min.	F Max.
0.025 to 0.063	1.26	1.12	0.46	1.33	0.38	2.75	3.88
" "	1.68	1.50	0.072	1.75	0.50	3.75	2.50
" "	2.92	2.52	1.46	3.08	0.88	6.25	1.76
" "	3.62	3.00	2.00	3.92	1.12	7.50	1.26
" "	1.26	1.12	0.94	1.90	0.38	2.75	
" "	1.68	1.50	1.56	2.50	0.50	3.75	
" "	2.30	2.00	2.32	3.50	0.70	5.00	
" "	2.92	2.52	3.00	4.40	0.88	6.25	
" "	3.62	3.00	3.82	5.60	1.12	7.50	



Materials: These beads may be formed in: Titanium alloy, RE-T-41, and titanium-pure, AMS 4901, hot or cold. Titanium alloy, RE-T-32, cold only

Because of the *H* to *W* ratio, the first four sizes can only be used where the *F* dimensions are maintained.

Radius *A* for RE-T-32, 0.063 in. thick, shall be 0.312. All other materials and thicknesses shall have radius *A* of 0.250 in.

Tolerance: $^{+.02}_{-0.00}$ unless otherwise noted

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❶ **Cut short-end scrap up to 48%!** Buy Asarcon 773 (SAE 660) and forget short-end scrap problems created by the standard 13″ bar. You order Asarcon 773 in the exact length you need — all the way up to 105″! And you save on handling and inventory costs at the same time.

❷ **Save almost ⅓ on diameter losses!** Buy Asarcon 773 and instead of ¼″ clean-up allowances, you have only 1/32″ to 3/32″ to machine. If you're currently using rough-cast bars, you may now be throwing away ⅓ the metal you buy! (Not to mention the waste if you buy solid bars and bore them out!)

❸ ❹ ❺ **Save these three other ways:** Buy Asarcon 773 and you save on machining time, since there's far less metal to remove. Buy Asarcon 773 and you get better service and longer life from your bearings — there are no blow-holes, pits, shrinks, sand or other foreign matter to cause trouble. Buy Asarcon 773 and you save on down-time — because you get greater yield strength, impact strength and fatigue strength than in the same alloy cast by any other method!

In short, buy Asarcon 773, and watch bearing costs tumble! For more information, talk to your local independent Asarco distributor, who stocks Asarcon 773 in 260 sizes of solids and tubes — or write us directly, and we'll demonstrate how others are saving with Asarcon 773.

ASARCO

Continuous-Cast Products Department

AMERICAN SMELTING AND REFINING COMPANY

Perth Amboy Plant, Barber, New Jersey • Whiting, Indiana

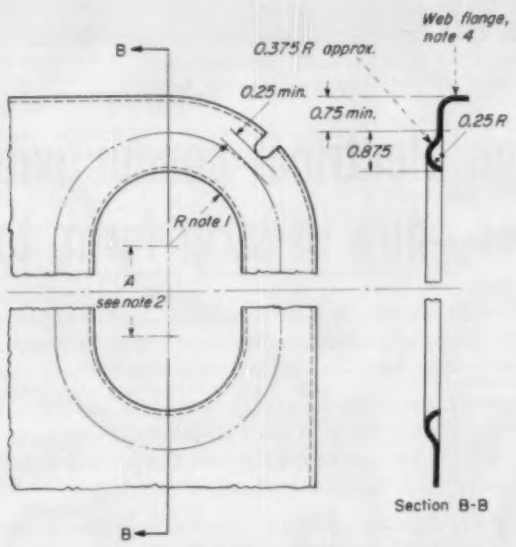
WEST COAST SALES AGENT: Kingwell Bros. Ltd., 457 Minna St., San Francisco IN CANADA: Federated Metals Canada, Ltd., Toronto and Montreal

Forming Data for Part Details . . III

Design Bend Radii*for Annealed Titanium Sheets

Gage	AMS-4901 Commercially Pure 70,000 psi yield	AMS-4908 Alloy 110,000 psi yield
0.020	0.03	0.06
0.022	0.03	0.06
0.025	0.03	0.06
0.028	0.06	0.09
0.032	0.06	0.09
0.036	0.06	0.12
0.040	0.06	0.12
0.045	0.09	0.16
0.050	0.09	0.16
0.056	0.12	0.18
0.063	0.12	0.18
0.071	0.12	0.26
0.080	0.16	0.26
0.090	0.19	0.32
0.100	0.22	0.32
0.112	0.25	0.38
0.125	0.25	0.44
0.140		0.50
0.160		0.62
0.180		0.76

*All bends made hot or cold

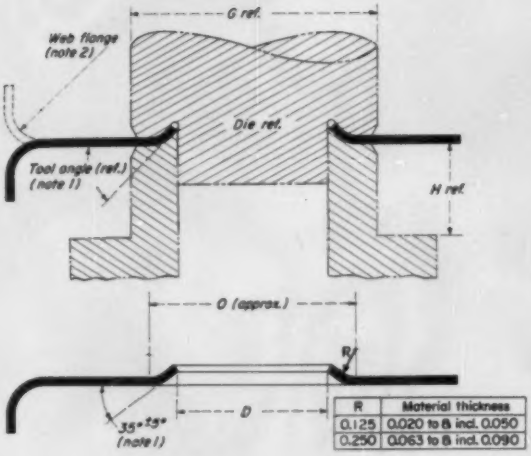


Lightening Hole—Elongated External

NOTES:

1. *R* to be in 1.00 in. increments with 1.00 *R* min.
2. A—This dimension to be in 0.50 in. increments.
3. Maximum material thickness = 0.051 in.
4. This lightening hole is more suitable where spotwelding of flange is desired. Hole flanged in direction opposite to web flange does not interfere with electrode.
5. May be formed in all aluminum alloys, annealed corrosion and heat-resisting steels, magnesium and titanium alloy.

Tolerance: ± 0.031 unless otherwise noted.



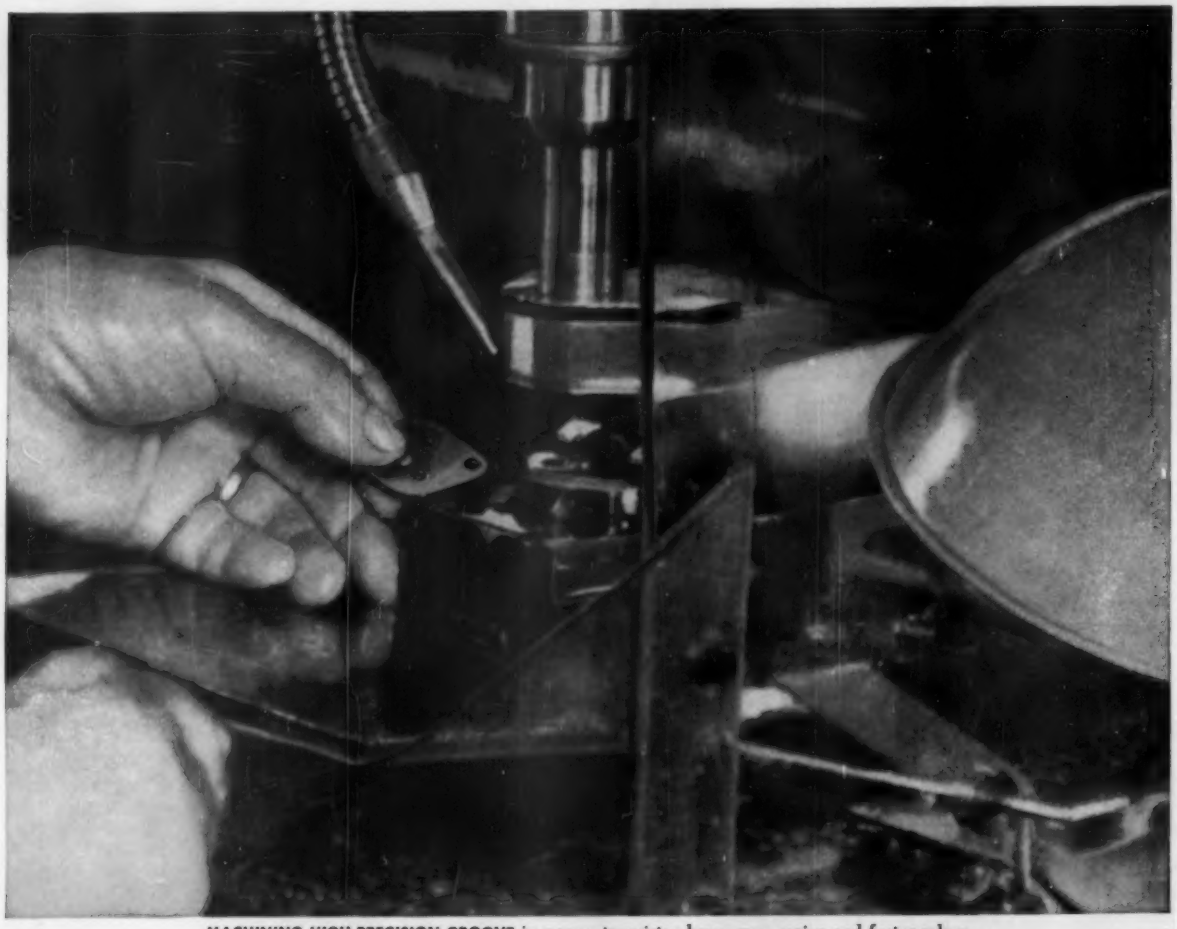
Dimensions of 35° Flanged Lightening Holes in Titanium

D ± 0.03	O (approx.)	G Ref.	H Ref.
1.00	1.562	2.000	1.000
1.25	1.812	2.250	1.000
1.50	2.062	2.500	1.000
1.75	2.312	2.750	1.000
2.00	2.562	3.000	1.000
2.25	2.812	3.250	1.000
2.50	3.062	3.500	1.000
2.75	3.312	3.812	1.250
3.00	3.688	4.125	1.250
3.25	3.938	4.438	1.250
3.50	4.188	4.750	1.250
3.75	4.438	4.875	1.250
4.00	4.688	5.188	1.250
4.25	4.938	5.438	1.250
4.50	5.188	5.688	1.250
4.75	5.438	5.938	1.250
5.00	5.688	6.188	1.250

NOTES:

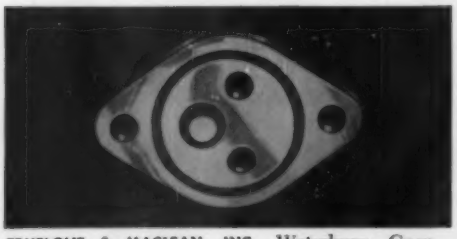
1. The dies should incorporate a 40° flanging angle for holes up to 1.75 in. and a 45° flanging angle for holes 1.75 in. and larger to allow for springback in the flange.
2. For applications where spotwelding of web flange is permitted, design should show the hole flange opposite to web flange.
3. This flanged hole is to be formed from titanium or titanium-alloy sheet.

Installment IV will be published in an early number



MACHINING HIGH-PRECISION GROOVE in power transistor bases was easier and faster when Truelove & Maclean, Inc., switched to Anaconda Leaded Copper-126 in strip form.

High machinability plus high electrical conductivity with Anaconda Leaded Copper—now in strip form, too!



TRUELOVE & MACLEAN, INC., Waterbury, Conn., started making bases for power transistors used in Motorola car radios from nonleaded copper. Bases are first stamped then have grooves machined. Specifications are strict; tolerances are close—±.002" on diameter of groove and ±.003" on most other dimensions. Tool cost was high—production slow. They were faced with the necessity of buying additional equipment to meet daily production schedules. An American Brass representative studied the problem, suggested Anaconda Leaded Copper Strip. The results: tool life increased 10 times; production was speeded 25%; over-all costs went down 25%—plus greater accuracy.

When you have to do complicated or precision machining on parts requiring high electrical properties, Anaconda Leaded Copper-126—now available in strip form—can save a lot of trouble and expense.

High machinability. Anaconda Leaded Copper Strip machines almost as readily as Free Cutting Brass. It has a machinability rating of 80%, compared with 20% for nonleaded copper. This means faster production and longer tool life—greater latitude in design.

High conductivity. Anaconda Leaded Copper Strip has an approximate electrical conductivity rating of 99% IACS.

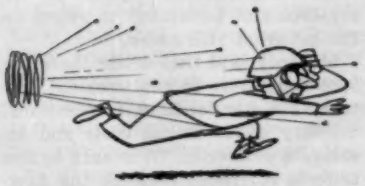
Get in touch with your American Brass Company representative for details of widths and thicknesses available. Or write: The American Brass Company, Waterbury 20, Conn. 577A

ANACONDA®

COPPER AND COPPER ALLOYS

Made by The American Brass Company

Talking Shop...



Chip Protector Needed

EVER WATCH a lathe run at 2500 sfpm while taking a healthy cut? We did recently, and it is an experience we won't soon forget. We were in a machinability lab watching some standard tests being run at 1500 sfpm. At our request, successive cuts were tried at progressively higher speeds. At 2000 sfpm things began to get lively. At 2500 sfpm, the chips were flying all over the lab like hot bullets and we were crouched in a corner behind a bullet-proof shield. We are all searching for tool materials that will stand up under higher speeds. This is a reminder that some extensive changes must be made in machines, not only to provide the speed, power, and rigidity, but to cope with the chips—first to stop them, then to dispose of them.

For Better Service

AN ANONYMOUS field service engineer has set down a dozen basic rules for getting better service on your machines. We are sure that the bitter experience that inspired him wasn't acquired in your plant.

1. Never send for a serviceman until everyone has had time to form their own opinion as to how to fix the machine. Have a man from each shift (so none will know what the other fellow has done) on the machine and leave off all parts weighing over 200 lbs.

2. After sending an "urgent telegram for the demonstrator to come immediately," put the guard wise so he can make it as tough as possible for him to get into the plant.

3. The minute the demonstrator arrives, ask him where he has been and what has kept him so long. Before he can answer, ask him how soon the machine will be operating again.

4. Hide all instructions and blueprints connected with the job he is working on.

5. Always have at least eight engineers present to ask technical questions which are in no way connected with the trouble at hand.

6. Ask him how soon the machine will be operating again.

7. Be sure to give him a helper who has never seen the machine before and also be sure the helper has no tools.

8. The machine should be as dirty and greasy as possible.

9. Tell the demonstrator what excellent service his competitors give with their machines. (Of course, we realize their machines almost never require any repairs.)

10. Ask him again how soon the machine will be operating.

11. When he finally gets the machine running, tell him what a swell job he has done, although he should do the job twice as fast.

12. After the demonstrator leaves, write to his company and tell them that the machine is worse now than it was before. This will give him a chance to come again and you can go through the above rules again.

Backsliding

WE WERE STARTLED to learn recently that one of our well-known universities has increased the requirement for thermodynamics to 17 hours in the course that passes for production engineering. This course was once considered a model because, among other things, it did not include much thermodynamics. We'd like to remind whoever was responsible for this backsliding that the steam engine is not much of a factor in a 20th Century manufacturing plant. Fundamentals should be taught, yes, but there are more fundamental changes in manufacturing methods than can be coped with in a course that is set to the needs of 1890. If we seem to be riding this subject pretty hard, it is because the school that backslid is our own, and we're ashamed of it for this. The students trained today who go into production work will need to know electronics more than they need to know steam; they need to know metallurgy and a lot of other basic subjects more than either one.

Tool Waste

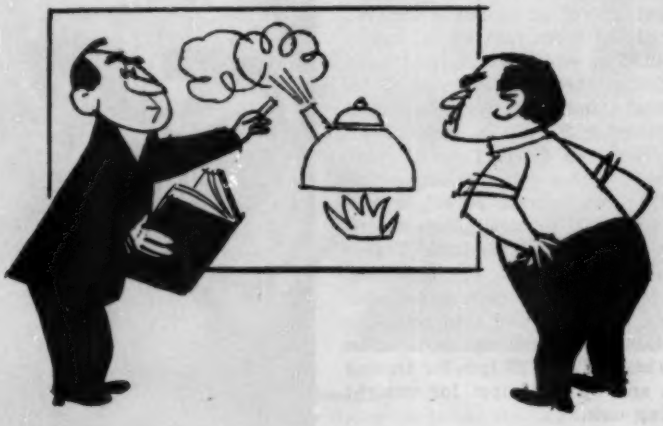
FOUR FACTORS that cause tool waste are listed by Fred Logsdon of Caterpillar Tractor. These could be listed as "human error" and accounted for 10% of tool replacement costs at Caterpillar in the last six months. They are:

1. Improper handling — causing nicked cutting edges.

2. Improper application—tapping a tool with a wrench to adjust it in a machine is typical of this problem.

3. Improper alignment—misalignment of a tool in a machine may break the tool and damage a piece part.

4. Running a tool beyond its normal cutting life—this requires additional grinding, and reduces the number of times a tool may be resharpened.



NEWS REPORT

NEWS REPORT

Missile Ball Gets Rolling—with

WASHINGTON—Against the highly-publicized backdrop of the Senate Prepardeness Subcommittee's missile investigation, more evidence of the missile program's stepped-up tempo continues to pile up:

● The Pentagon ordered both the Air Force Thor and Army Jupiter IRBM into production—a sharp reversal from previous policy which envisaged quantity output of only one of the missiles upon completion of flight tests.

● The Army was authorized to "soup up" its 175-mile Redstone surface-to-surface ballistic missile, now being produced in volume by Chrysler, into a missile with at least double the present range.

● The Air Force started construction of the first four Bomarc anti-aircraft missile bases—a network of the 14 launching sites is planned. The supersonic, ramjet-powered Bomarc was recently put into full-scale production by a team of contractors headed by Boeing, Marquardt, and Westinghouse. It has a range of about 300 miles, will augment the 25-to 75-mile air defense system of the Army's Nike Ajax and Hercules.

● Latest esimates of the administration's defense budget for next year are now for expenditures of between $39 billion and $40 billion—roughly $1 billion over fiscal 1958. Missile production spending is likely to rise about $2 billion to a total of some $4.5 billion. But much of this new cost will be offset by heavy slashes elsewhere in the military budget—presumably in manned aircraft, vehicles, guns, ammunition, and the like.

The Senate missile hearings had been billed as a non-political inquiry. But the first round ended two weeks ago on a note of political discord with Defense Secretary McElroy and Deputy Defense Secretary Quarles stoutly defending administration military policy before stiff criticism from Senate Majority Leader Lyndon B Johnson, the subcommittee chairman, and other members.

Quarles, a high-level Pentagon official since the start of the Eisenhower administration, was charged with "fostering a public feeling of complacency"—as Subcommittee Counsel Edwin L Weisl put it—by downgrading Russian missile and earth satellite exploits.

Weisl also complained that cost-plus-fixed-fee provisions in missile development contracts do not provide "incentives for improved, lower cost, and faster delivery" of missile hardware. He proposed that the Pentagon set up a system of "incentives and penalties" to speed up the program still more.

McElroy said that while there are such incentives in procurement contracts for standardized, conventional military goods to cut costs and accelerate deliveries, "it is hard to find criteria for incentives" in the new-fangled, burgeoning missile development field. He promised, however, to study whether missile contracts can be revised to allow incentives for the producers.

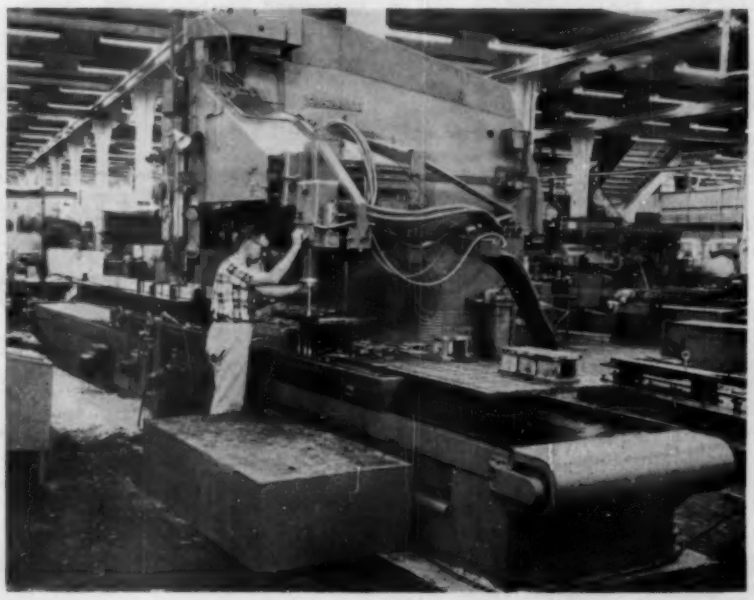
Revamp Defense Dept?

McElroy also hinted strongly of plans to revamp the Defense Dept's massive and complex organization—a subject which generated considerable controversy before the Subcommittee over delayed decisions and other snafus in top-priority missile and satellite projects. Said Weisl to McElroy: "you wouldn't tolerate such complexity in your (private) business."

In earlier testimony, Lieut Gen James H Doolittle and Vannevar Bush had proposed the creation of a general military staff—separate from the three services—to advise the De-

Profile Millers 33 Feet Long

BALTIMORE — Largest Cincinnati Hydro-Tel milling machines on the East Coast—each with an overall length of 33 ft—are now automatically milling aluminum detail parts for the Martin P6M SeaMaster. Longitudinal travel of tables is 168 in., that of the cross ram 48 in. Tables are 45.25 in. wide, 208 in. long, have maximum throat distance of 60 in. Vertical spindle travel is 24 in., and machine has 20 spindle speeds from 16 to 1600 rpm. Head of one machine can mill with a variable angle cutter that can operate at 20°, as opposed to usual 90° milling operations on a conventional machine. Tracer control gives 0.0005 in. tolerance. Bed table unit has rack and double pinion feed box, and feed rates for the table are infinitely variable in the range of 1 to 25 ipm for tracing cuts, and up to 50 ipm for straight milling cuts.



NEWS REPORT

a Shove from Senate Probers

fense Secretary on defense policy.

In ordering both the Thor and Jupiter IRBMS into production, McElroy said that neither missile has been "thoroughly proven" so far. The earlier output—and in heavier quantity than originally planned—is frankly described by most officials as a gamble to counter obvious Russian advances in rocket technology.

The IRBM Contractors

Major contractors on the Air Force Thor: Douglas Aircraft, prime contractor and airframe builder; General Motors' AC Sparkplug Div. and Bell Telephone Laboratories, electronic guidance systems; General Electric, nose cone.

On the Army Jupiter: Chrysler, airframe; Reynolds Metals, airframe subassemblies; Sperry-Rand's Ford Instrument Div, guidance; and Goodyear Aircraft, nose cone. North American Aviation produces the rocket engine for both missiles.

Under the Air Force's weapon system development program, Douglas was allowed to tool up for volume production simultaneously with the development efforts. Chrysler, however, is not tooled up yet for quantity output—the Jupiter was developed at the Army's Redstone Arsenal, Huntsville, Ala. The question of how much new tooling Chrysler will be authorized to set up was still being reviewed as *American Machinist* went to press.

Thors for test launchings were built with production tooling: Jupiters have been fabricated as "hand-tooled" or "model shop" prototypes.

According to unofficial estimates, Douglas' full production capacity is supposed to be at least 50 missiles a month. Production has been running at only two per month, has been boosted to four, and will shortly rise to six. Peak production under the new orders is not expected to go over 25 by next year. The rate of Jupiter output is expected to be kept much lower.

Pentagon officials say that production of subsystems and components for the IRBM's will not limit assembly of end-items—that is, the major suppliers have already tooled up to handle peak missile production.

There is considerable grumbling in the Pentagon—notably in the Air Force, which has operation responsibility for the IRBM—over the decision to produce two different weapons. Says one Defense Dept missile official: "This is not the most efficient way of doing business by any means. The decision would have been different without the political pressures."

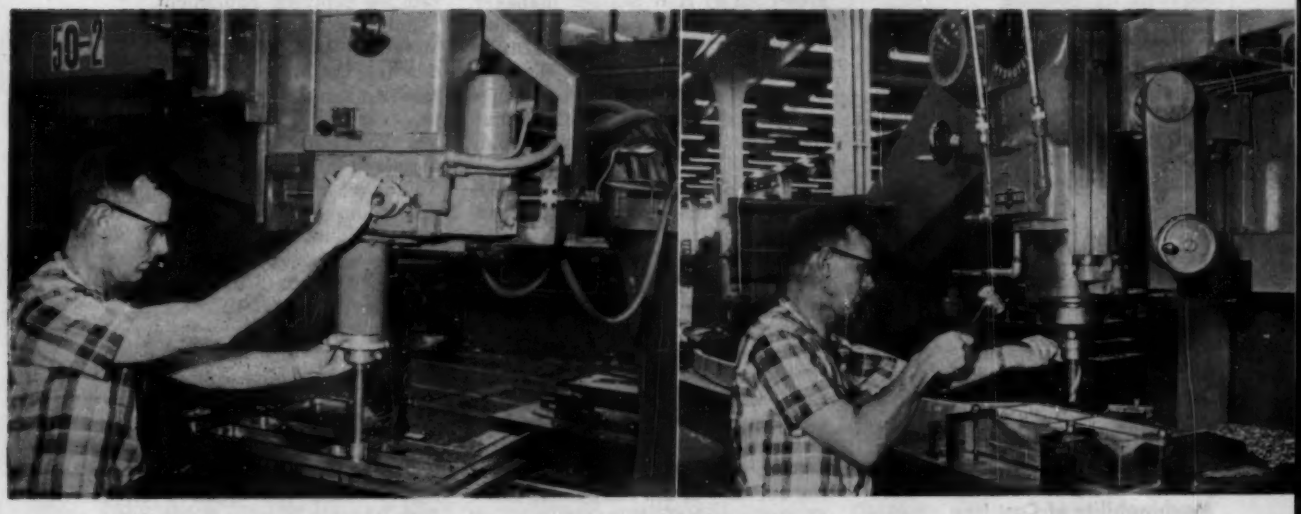
Although the two IRBM's are similar in overall design and performance, crews trained to handle Thor, for instance, and launching sites equipped to fire the Air Force IRBM will not be able to launch the Army Jupiter—at least under initial training and installation plans.

The basic differences are in construction of the inertial guidance systems and nose cones. Thor's guidance system, has a liquid-floated gyroscope, for example; Jupiter's is an air-floated gyro.

Missile Model T's?

As the IRBM's go into production, military experts stress that the current versions of both Thor and Jupiter are only "Model T's." Advanced models will be powered by solid rocket fuels instead of liquid propellants, have more precise radio-inertial guidance systems, will be smaller and more adaptable for mobile field launchings. Theoretically, the current IRBM's have mobile capability, but plans are to use fixed installations for the first few operational squadrons.

Go To Work on the Martin SeaMaster



Setting the tracer control . . .
to guide cutter so it can automatically mill aluminum detail parts for the SeaMaster

Adjusting the head . . .
of the Cincinnati Hydro-Tel before starting it on the milling of an aluminum detail

ASME Irons Out Some

Production and Process Problems

NEW YORK—Research in metal cutting, chipless production, and handling problems in automated lines were highlights for production men of the annual meeting of ASME held here Dec 1 to 6. A record number of technical sessions were included in the meeting.

Clarence E Davies, who is retiring after 23 years as secretary of ASME, was honored at the banquet. Mr Davies will continue as coordinator of the United Engineering Center (*AM*—Dec 2 '57, p141) to be built on United Nations Plaza in New York. New Secretary is O B Schier, II, a staff man since 1946.

Cutting Fluids in Reaming

The only information available on the influence of lubrication on reaming has been a Russian research report (*AM*—May 7 '56, p134). The results of this research did not appear to be consistent with some preliminary work in this country, so the subject was explored further by L V Colwell and Henrik Branders at the University of Michigan.

The cutting fluids studied were carbon tetrachloride, chemical emulsion concentrate, butyl stearate, and dry. The presence of a built-up edge at the outer corner of end-cutting reamers was found to affect hole size, surface finish, and the torque required for reaming.

Carbon tetrachloride and chemical emulsion concentrate were found to reduce the size of built-up edges on reamers to such an extent that substantial rubbing occurs between the wall of the hole and the reamer margin.

A dull reamer in the presence of a good lubricant can continue to produce good surface finish and close control of diameter. The same lubricant with a sharp reamer might fail to prevent significant loading, thus resulting in poor finish and size control.

Higher torque in reaming is not necessarily bad since it may be the result of burnishing which can produce better finish and closer control of hole size.

Machinability of Cast Iron

Cutting force varied as much as 20% in Class 40 cast irons from nine different foundries, all of which had the same microstructure. This startling challenge to the accepted idea that microstructure is the major factor in determining machinability was presented by I Ham, University of Wisconsin, and J R Roubik and J P Bunce of Kearney & Trecker.

At any given cutting speed, the ratio between the best and worst tool life in minutes was 4:1. No correlation between tool life and individual mechanical properties, chemical constituents, or tool force was apparent, and good correlation could not be obtained with combined carbon and a large number of various combinations of chemical constituents.. However the nucleation tendency did give fair correlation.

A formula was developed for a chemical composition rating that gave better correlation (in these nine cases) than anything else tried:

Chemical composition rating = 9.5 (total carbon) + 4.3 Si + 2.2 Si/Mn − (2 Mo + 2 Mn + Cr + P).

A composite average chart for production rate and tool life was developed from the nine Class 40 irons and is reproduced on the opposite page for shop use.

Chipless Production

The economies of the roll-forming process (*AM*—May 5 '55, p126) were presented by K W Stalker, manager, mfg engrg and process development at the Aircraft Gas Turbine Div of General Electric. This is the cold power spinning process performed on machines such as the Cincinnati Hydrospin and the Lodge & Shipley Flo-turn.

Where difficulty has been encountered with this process it has generally been from a failure to appreciate the interrelation of nose-roll radius, stock thickness, and feed rate. With proper analysis of the factors, all of the ductile materials can be roll formed from blanks into conical and cylindrical parts. Parts can usually be made to finished dimensions.

Cold forming generally improves the physical properties and reduces the ductility of the component. Some of the materials that GE has roll formed cold are A-286, M-252, R-235, AISI 4340 and 1010, and most grades of aluminum. Titanium and molybdenum have been heated when rolled.

Measuring Cost of Automation

Methods of measuring the results of automatic assembly (the assembly methods involved were described in *AM*—Oct 8 '56, p122 and Oct 7 '57, p105) were described by A J Dunkle, supt, production engineering, AC Spark Plug Div, General Motors.

First step involves determining total actual cost of the existing method of manufacture. Next step is to establish the most economical manual method with present facilities. This involves an accurate methods motion study of existing manual operations and usually results in improvements that lead to a substantial reduction in direct labor costs with little or no investment.

In both present actual cost and improved manual method, it is essential to determine actual burden. It is not uncommon for total burden to be twice the direct labor cost. Hence it is essential to determine the impact that mechanization will have on unit burden cost.

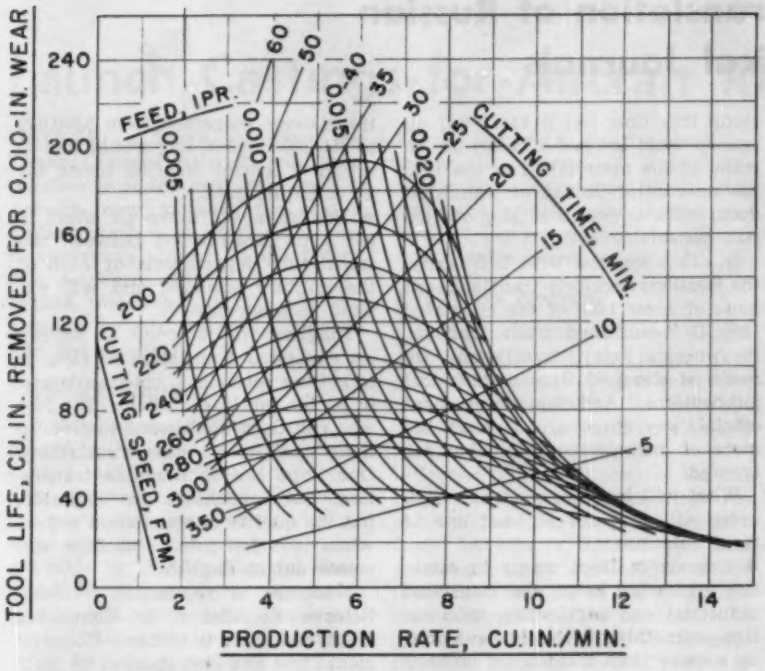
As full mechanization is approached, capital investment usually increases at a higher rate than the reduction in unit product cost and maintenance costs rise at a higher rate on complex equipment.

Industry in general and General Motors in particular distribute burden on the basis of direct labor, said Mr Dunkle. The deficiencies of this method were not created by mechanization, but they have been increased by it.

Four ways to control machine depreciation cost per unit volume are:

- Reduce the cost to design and build a machine.
- Make it flexible so as to get the optimum in useful life.
- Develop an effective preventive maintenance program.
- Keep the machine running.

In special studies at AC Spark Plug, every case studied indicated that as capital investment increases, maintenance costs increase. Further, higher skills are required on the part of the repairman. Repetitive maintenance on a particular mechanism has pointed the way to im-



Relationship of production rate to tool life . . .

for Class 40 cast irons developed from samples with similar microstructures produced by nine different foundries

provements in a machine's design.

In-process Storage Problems

Experience of Whirlpool Corp in solving the storage problems of an integrated line was reported by Charles D Leslie, supervisor of tool design and development. To establish bank sizes, an estimate was made of the number of hours it would take to repair any particular piece of equipment in the line on anything but a major breakdown. Then, the number of parts required for succeeding operations to maintain production schedules for this period, plus the time to get parts from one operation to another, is the size of bank required.

In press and welding, lines are banked while still in the flat, by stationing a man on the line to palletize the extra blanks. If there is die breakage, the palletized parts are used to keep the welding line going. If there is no breakdown, the bank is used for the last portion of the run on that model, while die changes are made in the presses.

Floor space for this banking was reduced by storing the pallets in formed-channel storage racks.

As the end of the welding line a conveyor holding 450 cabinets leads to the paint line. Originally this storage line was a combination raw-storage and catastrophe line. Working storage is required because the welding line runs faster than the paint line. Invariably, a breakdown on the welding line would occur when working storage was low. Now another storage line has been added and they serve alternately as working storage and catastrophe banks.

Originally there was a variation in the number of people required on the assembly line, depending on which model was being run. This amounted to 10 to 15 people, and posed a problem in utilizing these people on sub-assembly lines. The solution seemed to be to have constant manpower on the line and vary the line speed. This presented a problem in balancing for the production engineers, but the results have been very satisfactory.

The line formerly ran at 1000 units per shift, now it varies from 900 to 1300 units depending on the model. There was a marked improvement in quality and the people are much happier with this setup. There was an increase in productivity on the assembly line.

Looks Like No Excise Tax Refunds For Manufacturers

WASHINGTON — It now looks as though $1 billion in excise tax refunds expected by many manufacturers will not come through because of a recent ruling by the U S Court of Claims. But it's still not official: final word must come from the Supreme Court. Nevertheless, government attorneys say at least 30 such refund claims now pending will be dismissed because of the ruling.

The principle announced by the Court: companies cannot get an excise tax refund for money they spend to provide parts and services under standard warranties.

GM, Ford Test Cases

GM's Frigidaire Division and Ford Motor Co have both lost out so far on test cases, but Ford is expected to appeal to the Supreme Court on grounds that its 90-day repair and replacement warranties should be deducted from the new car sales price, upon which excise taxes are based. If successful in its claim, Ford stood to get an $8.9 million refund for the years 1949 through 1954.

The Court of Claims rejected Ford's appeal because the money Ford spent was not a "readjustment of a sales price or a rebate or an allowance"—but merely an expenditure "to make good the manufacturer's representation that the article sold was free of defects"—and as such had no bearing on price.

Most pending claims have been filed by auto, TV and appliance firms. There is a possibility they all won't be washed out, the Court of Claims says it doesn't believe manufacturers should have to pay excise taxes on money received from the sale of long-term "special protection" warranties, such as the one offered by Frigidaire for $5. If the Court finds this a reasonable charge, Frigidaire will get a refund on the excise tax collected on warranties.

Other manufacturers might be able to bring part of their impending claims under this same limited area of relief, but if the Court of Claims rulings are upheld by the Supreme Court, manufacturers in the future may have to make special charges for warranties, or at least change the nature of their warranties.

NEWS REPORT

Urge Speed-Up in Translation of Russian Scientific and Technical Journals

WASHINGTON—The U S has had a definite blind spot in its race with Russia for world technical and scientific supremacy—lack of an organized program to translate information to be found in Russian technical journals. That was pretty evident when Russia caught the U S flat-footed with Sputniks I and II.

Surely, the public said, some hint of Sputnik must have appeared in Russian technical publications? And it had—only nobody in the U S, apparently, had bothered to read and translate it.

That's why this situation has top priority on the agenda of Dr James Killian, the President's new advisor on science and technology.

Weakest spot in the U S program is failure to make more than token efforts to translate the wealth of available Russian material. The Interdepartmental Committee on Scientific Research and Development tries to keep its member agencies informed as to what each is doing along this line, but it can't tell an agency what to read or what use to make of the material. Too, the U S has no central library of translated documents, or even a catalog of Russian material.

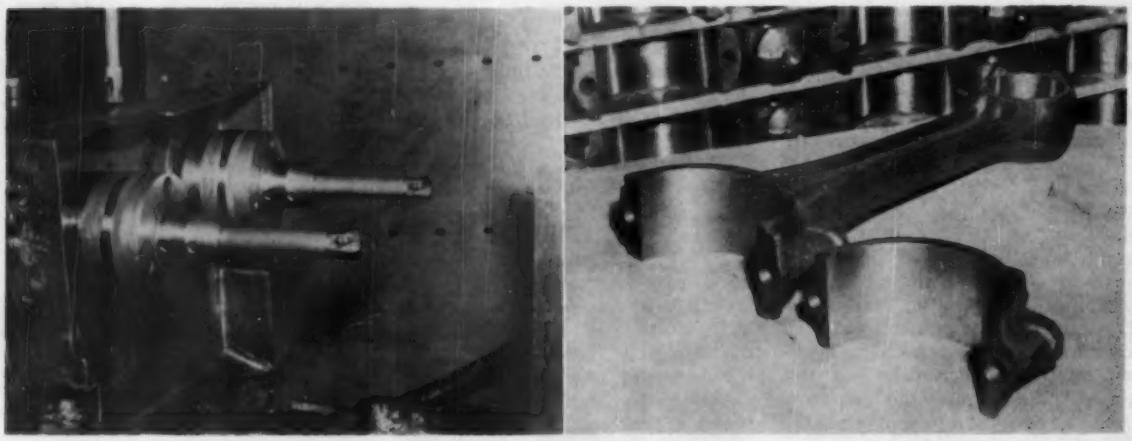
In sharp contrast with U S laxity, the Russians regularly translate each issue of some 1400 of the estimated 1800 U S-published trade journals. In America today, translations are made of about 40 Russian technical publications. And top government officials say there are at least 160 more of prime importance that are ignored.

What will be done about it? Congress will plug for at least one of these solutions:

- Commerce Dept wants to establish a clearing house for translated industrial and engineering information—something it should have done on a more than token scale when it was authorized by Congress in 1950.
- National Science Foundation wants to have its annual budget for translations increased from $300,000 to $500,000 and it, too, would like to set up a central clearing house for all scientific data.
- Pentagon will make an effort to get some coordination between the translating departments of each of the military services, and will expand such services.

Toughest nut to crack in setting up expanded translation services is in getting specialists, not translators, to do the job in each field. The few who can do it don't want to give up their work to do mass translations. One hope lies in machine translation. Such machines are available, but the quality of translation suffers when it is fed into a machine and comes out in English.

Machines or specialists, National Science Foundation or Commerce Dept, one thing is certain—Congressional hue and cry, spurred by public opinion, is going to light a real fire under U S scientific translation policies within the next few months.



Solution to a Tough Boring Problem

Carbide-encased boring bars with throw-away carbide insert tools eliminate need for piloted bars in many boring operations because the carbide sleeve increases the bars' stiffness. One problem solved at Kennemetal Inc, Latrobe, Pa, involved boring 1-in. bolt holes in connecting rods and caps for diesel engines (setup is in left photo, the 1-in. bolt holes are visible in right photo). Necessary hole tolerances of +0.001 in., -0.000 were held at first with extreme difficulty—tools broke, boring bars wore out and had to be replaced. Using the new carbide encased tool, tooling costs were cut from 49¢ per piece to 8¢ for the first 4423 pieces bored, over a one-year period. Two old-style boring bars with 4-in. pilot and 6¾ in. shank, and 246 carbide tipped tools, were pitted against two Kennemetal-encased boring bars with 30 Kendex inserts in comparison tests on the two sets of 4423 pieces. Cost of the former plus grinding was $2171.42, of the latter $360.30. Average life of piloted tools was 10 holes per grind for rough cut, 30 holes per grind for finishing cut, as opposed to 560 and 640 holes respectively. Machining time was cut in half

FIELD REPORT

NEWS REPORT

Launch Castings-for-Aircraft Research

DALLAS — Three foundries and Chance Vought Aircraft will work together over the next two years to develop new methods for casting high-strength steel alloys to be used in supersonic aircraft of the future. The Air Force will pick up the $1,093,854 research tab, it was announced by Air Materiel Command late last month.

High-Temp Castings

Primary purpose of the Air Force project is to develop processes of casting high-strength steel into complex shapes capable of withstanding extreme temperatures. Development data will ultimately be made available by the Air Materiel Command to all foundries engaged in making castings for military aircraft. John K Dietz, Chance Vought structures materials engineer, will be project engineer for the contract, which Chance Vought was awarded over 10 competing aircraft manufacturers.

In today's supersonic aircraft, most steel castings are used at temperatures in the neighborhood of 275 F. But with the projected increase in speeds of tomorrow's planes into ranges of 1500 to 2300 mph, the metals used in the aircraft of the future must be able to stand temperatures to 1000 F.

Five-Phase Program

In line with this, Chance Vought will undertake a five-phase program. First step will be to select the three foundries to do the development work on actual aircraft parts designed by Chance Vought.

Second phase will involve laboratory tests to select steel alloys capable of being stressed to anywhere from 180,000 to 220,000 psi, and working out of methods to make them castable. One of the program's final goals will be the production of usable castings with a tensile strength ranging from 260,000 to 300,000 psi.

Phase Three involves design of actual parts to be cast for Vought by the foundries—and changes in design may be called for after preliminary castings are made.

Fourth phase covers trial production of a contoured part in large lots to see if it can be produced in quantity.

Final phase will go into pilot production of selected castings in quantities sufficient to establish consistent results.

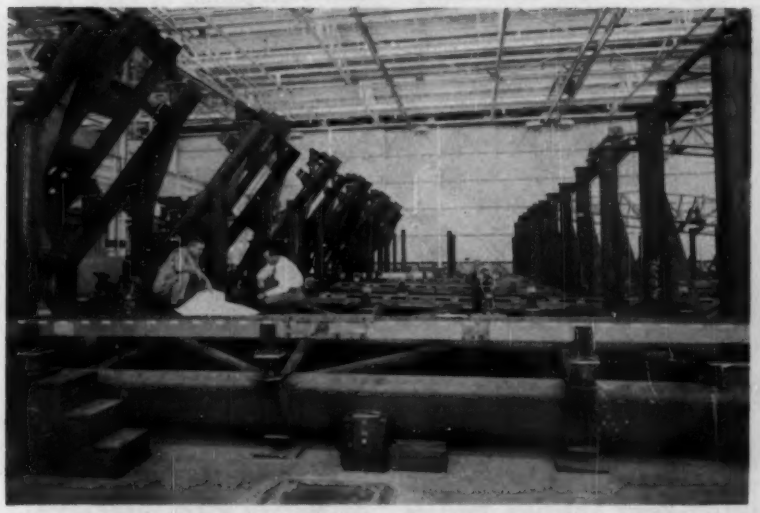
Money-Saving Is the Goal

Theory behind this research and development project is that cast parts can effect considerable savings over other methods of fabrication in many instances in the aircraft industry.

Chance Vought has long been a leader in development of such high-strength steel castings for aircraft. The F8U-1 Crusader, for instance, contains several such castings capable of standing up under the heat generated by this 1000-mph-plus supersonic jet.

Maybe it was with this project in mind that Chance Vought last spring invited more than 80 foundry executives to a Steel Casting Symposium in Dallas to outline the casting needs of today and the future in the aircraft industry.

"Longest, Largest" Scotchweld Assembly Wing Bucks



Six wing bucks, "longest and largest ever made for Scotchweld assembly," will shortly be in use at Convair San Diego as part of its Convair 880 jet transport program. Each fixture is 90 ft long, has a maximum width of 10 ft, maximum height of 22 ft. Wing is positioned on the tool by use of a pivoting end plate to which center tie box of the wing is attached. Tie box is brought into the fixture by pivoting the end plate to the end of the leading-edge spar. Wing is built in the structure with the leading-edge spar at the bottom. Advanced optical tooling sets locations

FIELD REPORT

FIELD REPORT

East...

United Drill to Merge With Greenfield Tap & Die

Plans for merger of Greenfield Tap & Die Corp, Greenfield, Mass, and United Drill & Tool Corp, Chicago, have approval of directors of both companies. New firm will be known as United-Greenfield Corp.

Holders of Greenfield common would receive 1.15 shares of common stock of the merged corporation for each share held. Stockholders of United Drill would receive one new common share for each share of United held.

Michael J Kearins, United chairman, will become chairman of the combined company. Donald G Millar, president and chairman of Greenfield, will head the executive committee of the new concern. Konstantin Kronwall, United's president, will be president and chief executive officer of United-Greenfield.

Eastern briefs . . .

Bethlehem Steel's $200-million-plus expansion program at the Sparrows Point plant, scheduled for completion next year will make it the world's largest steelmaking unit, capable of annual production in excess of 8.2 million ingot tons. Current employment of 29,000 will be upped to 32,000 when plant is operating at capacity. **Bethlehem-Sparrows Point Shipyard** has a peacetime record of 27 ships on order, is filled to capacity until 1961 . . . **Westinghouse Electric,** Pittsburgh, has a $2 million contract to build six turbine generator units for the Navy's first nuclear-powered surface ship, the USS Long Beach. Order came from **Bethlehem Steel** at Quincy, Mass, designer and builder of the guided missile cruiser . . . **Nicholson File Co,** Providence, RI, is purchasing the **W O Barnes Co,** Detroit maker of hack and band saws. Management and sales policies of both companies will remain as is . . . **Firth Sterling Inc,** Pittsburgh, has a $1.5 million order from **Westinghouse Electric** for melting of zirconium ingots from sponge, and conversion into finished mill products. **Firth** will double its melting capacity by the first of the year with addition of new melting facilities, is also installing an experimental furnace for evaluation of zirconium alloys . . . **Metal & Thermit Corp,** New York, has sold its Thermit welding business to **Reade Manufacturing Co,** Jersey City, NJ, firm engaged in the railway supply and powdered metals fields . . . Merger of **Copperweld Steel Co,** Pittsburgh, and **Superior Steel Corp,** Carnegie, Penna, has been legally completed. **Superior's** facilities are being operated as the **Superior Steel Division of Copperweld.**

Discuss "Executive Reserve" Plan

Talking over the problems of setting up an executive reserve plan for the government at the recent two-day Defense Executive Reserve Conference, held in Washington in mid-November, are, from left: Secretary of Defense Neil H McElroy, Niels A (Andy) Olsen, director Metalworking Equipment Division, Business & Defense Services Administration; and Swan E Bergstrom, executive vice president, Cincinnati Milling Machine Co. More than 1200 executives from industry, agriculture and the professions were welcomed by President Eisenhower and Vice President Nixon as they met to discuss a plan whereby top men from industry and other fields could be brought into Washington for training to take over various top government posts in the event that government heads were to be wiped out in a bombing of the nation's capital

West...

Marquardt Aircraft Co, Van Nuys, Calif, has programmed the second round of expansion of its Ogden, Utah, ramjet engine facility. Project, to cost between $1.5 to $2 million, involves addition of 110,000 sq ft, doubling plant's present footage. The Van Nuys unit is becoming a primary research and development center for the company, with manufacturing being stressed at Ogden . . . **Horkey-Moore Associates,** Torrance, Calif, has formed a Testing Division for complete evaluation, qualification, and reliability testing of mechanical, electronic, hydraulic, and pneumatic components for aircraft and missile use . . . **Richard Ives Machine Tool Co,** Denver, representing 30 nationally known machine tool builders, is putting up a new 10,000-sq-ft office and warehouse building . . . For the first time in its history **North American Aviation** fiscal year sales exceeded one billion dollars. Company estimates, however, that sales for the 1958 period will drop to $700 million because of termination of the Navaho missile program in July, and declining schedules in other programs. Company's current backlog is $581 million, lowest since 1951. The '56 backlog amounted to $1,285,000,000 . . . **Torrington Manufacturing Co,** Western Division, has opened a plant in Van Nuys, Calif, for manufacture of air impellers for the air conditioning and appliance industries . . . **H & B American Machine Co,** Los Angeles and Chicago, has bought the **Big Boy Manufacturing Co,** Los Angeles. The $2 million purchase was described as a step toward diversification in non-defense lines for **H & B,** currently engaged in production of structural parts and airframes for military aircraft . . .

FIELD REPORT

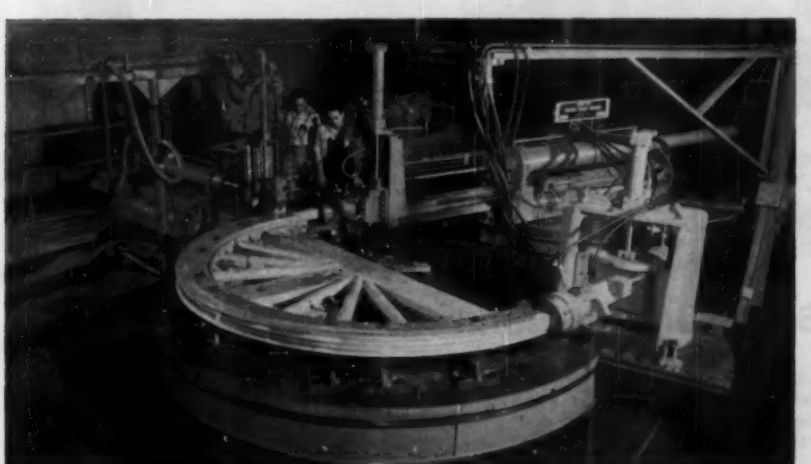
FIELD REPORT

Stockholders of **Friden Calculating Machine Co,** San Leandro, Calif, have approved change of company name to **Friden, Inc.** Shift was desired because of expansion in the firm's office equipment lines during recent years . . . **United Air Lines** will build a $4 million jet maintenance center at San Francisco International Airport. Construction will start in the spring and is scheduled to be finished by May 1959, about the time **UAL** will put its first jets into service . . . **C W Marwedel,** San Francisco industrial supply company handling tools, metals, abrasives, and power transmission equipment, has set up a branch sales office and warehouse in San Jose, Calif.

New St Louis assembly plant for Plymouth . . .
This is how Chrysler Corp' 1.3-million-sq-ft Plymouth assembly plant near St Louis will look when it's completed in the spring of 1959. Foreground is the two-story office building: new cars come off the assembly line into loading area at right. The plant, which is on a 200-acre tract 20 miles southwest of St Louis on Hwy 66, will start output with 1960 Plymouth models

Midwest...

Westinghouse Electric Corp has a new $9 million order that increases a recent Navy contract to $26 million for production of jet aircraft engines at the aviation gas turbine division plant in Kansas City. Original $17 million order covers production of engines during 1958; new contract calls for delivery throughout most of 1959 . . . **Motch & Merryweather Machinery Co** has been named exclusive distributor of the line of mechanical presses and special hydraulic machinery made by **Danly Machine Specialties,** Chicago. Distributorship area covers **M&M** territories with offices in Cleveland, Cincinnati, Detroit, Dayton, and Pittsburgh . . . **Hercules Motors Corp** will take over manufacture of two Lycoming air-cooled industrial engines now being made by **Avco Manufacturing Corp's Lycoming Division** in Williamsport, Penna. **Hercules** has acquired the tools, dies, patterns, and inventory, expects to start production in Canton, Ohio, about March 1 . . . Plans are in the works for a multimillion-dollar expansion and improvement program at **Borg-Warner Corp's Calumet Steel Division** in Chicago Heights. First stage of the program, scheduled for completion by the end of next year, calls for increasing capacity by at least 40%. Second phase involves installation of electric furnaces and additional rolling and finishing facilities by mid-1961 . . . **Howard Industries, Inc,** has bought **Westinghouse Electric's Universal Motor Division,** Lima, Ohio, for an undisclosed amount. It'll move all machinery and equipment to its plant in Racine, install it in a recently completed 35,000-sq-ft addition. **Howard** expects acquisition will up annual sales by $2 million . . . **American Bosch Arma Corp** has opened a new 20,000-sq-ft plant in Oak Lawn, near Chicago. It'll design, develop, and produce complex test equipment and ground support equipment . . . **King-Seeley Corp,** Ann Arbor, Mich, manufacturer of power tools and electrical control devices, has bought **Queen Products, Inc,** Albert Lea, Minn, maker of oil and gas heaters, ice-making machines, and finishing and deburring equipment . . . **Bates Products, Inc,** Chicago specialists in production of resin-bonded abrasive sanding disks, is offering a free consulting service to help solve abrasive sanding disk problems in manufacturing plants . . . Expansion of **American Can Co** facilities during the year will total about 1.5 million square feet in



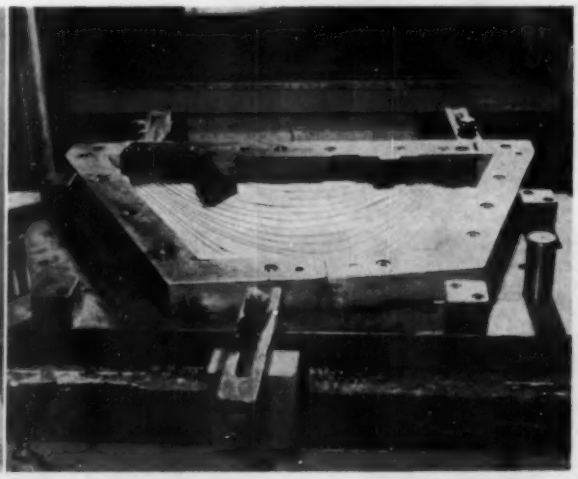
Giant radial draw former for Convair San Diego . . .
Claimed to be the world's largest, this Cyril Bath radial draw former is now in production at Convair San Diego, forming roughly semicircular shapes by stretching them around a turntable form to produce belt frames and other parts for the Convair 880 jet transport. Draw former is shown stretching a heavy H-beam into shape, employing a 75-ton pull to do it

FIELD REPORT

15 locations, including a major new facility in the Chicago area and four other additions in the midwest. New factory, designed for company's coil processing program, is nearing completion at Hammond, Ind.

South...

Lockheed Aircraft has transferred responsibility for production and modification of the C-130 Hercules, now produced at the Marietta, Ga, plant, from the Sacramento, Calif, Air Materiel area to the Warner Robins, Ga, Materiel area . . . **Chevrolet Motor Division** expects to double the size of its Atlanta assembly plant with addition of approximately 385,000 sq ft. Cost is estimated at $10 million . . . New $1-million **Joseph T Ryerson & Son** steel service plant at Charlotte, NC, has gone into operation. It'll supply the Southeast with bar, structural, plate, sheet, and tubular steel . . . **Reichhold Chemical Co** will build a multi-million-dollar plant at Hampton, SC . . . **Lyon, Inc,** is adding a 12,800-sq-ft addition to its southern division plant at Huntland, Tenn. New space will be used to turn out stainless steel sinks, product recently added to the company's line . . . **Highland Rim Machine Works, Inc,** has set up operations in Dickson, Tenn . . . An AF station for testing guided missiles will be put up near Tarpon Springs, Fla. It'll be built on a 420-acre site fronting the Gulf of Mexico, near the mouth of the Anclote River, and will be operated under supervision of the **Vitro Laboratories . . . Lockheed Aircraft's** nuclear aircraft research project at Dawsonville, Ga, will be working full speed by end of next year. Cost of the project is said to be about $15 million, with eventual potential outlay of $50 million . . . **Lockheed** also says that its Marietta, Ga, Div, previously used only for aircraft production and modification, will concentrate on manufacture of heavily shielded atomic energy furnaces. This'll be part of a special project, initiated by the company when it was told that the Air Force didn't plan to contract for total capacity of the test reactor being built at its Dawsonville nuclear project . . . Chattanooga Works of **Western Union Co** has a multi-million-dollar contract from the Air Force to make automatic teletype equipment to be used at air bases. Plant has been enlarged already to handle production, under the contract, which will be spread over a 10-yr period . . . **Heat Transfer Products, Inc,** has begun operations in Paris, Tenn. It'll make units for equipment used by oil refineries and other large installations . . . **Southern Electrical Co,** a division of **Olin Mathieson Chemical Corp,** has started to put up a $90,000 warehouse addition to its Chattanooga plant . . . **Harvey Aluminum Sales, Inc,** subsidiary of **Harvey Machine Co** of Torrance, Calif, has been named operating contractor at the Milan, Tenn, Arsenal. **Harvey** succeeds **Procter & Gamble** as contractor . . . **Linde Co,** producer of liquid oxygen, plans to build a 10,000-sq-ft manufacuring plant in Nashville.



Fiberglas Laminate Solves Missile Control Problem

It takes 150 layers of Fiberglas, tapered in three directions, to make a nose control trimmer for the Regulus II missile at Chance Vought Aircraft, Dallas. Missile's nose trimmers had to be built with a material that wouldn't affect radio transmissions that control the Regulus II's flight. Metal trimmers couldn't be used, nor could machined Fiberglas parts, because exposed edges of the cloth would split into layers at high speeds. Chance Vought's bonding shop solved the problem by using a 150-ton press and 320 F heat. Some 50 different patterns are used in cutting the Fiberglas because the thickest part of the nose trimmer contains 150 layers, the thinnest only six, and the tapering must be aerodynamic. Patterns were cut in the cloth in its soft stage, then pre-cured to dry out excess solvents and moisture. Largest patterns are laid out in the bottom half of the die, tapering to the smallest in the middle, then building up again to the largest on top of the pile. Dies are then pressed together and heated to 200 F to vent gas and warm up the resin. Temperature is raised to 320 F after half an hour, and full 150-ton pressure is applied for 2½ hours. Part is cooled, inspected, and placed in an oven at 180 F for four hours, plus a post-curing period at 350 F. Trimmers are then joined with a steel casting "axle"

Ervin J Baumrucker (left) has been appointed vice president, domestic press sales, for Clearing Machine Corp, division of US Industries, Inc, Chicago. He was formerly general sales manager. **Eugene P Cunningham,** vice president, sales, for Clearing Machine Corp, division of US Industries, Inc, Chicago. He sume additional administrative duties as Clearing's program to diversify and expand its product lines is developed

John R Keates has been named general sales manager of the Machine Tool Division of National Automatic Tool Co, Richmond, Ind. He was formerly New York regional sales manager

NAMES IN THE NEWS...

William C Schumacher, vice president of International Harvester Co, and executive head of its Motor Truck Division, has been elected executive vice president of the company.

C Frederick Crow, master mechanic of the Bristol, Conn, plant of GM's New Departure Division, has been promoted to plant manager. Other appointments at Bristol are **Lester A Lanning, Jr,** factory manager; **George W Linder,** master mechanic; and **Philip H Schmitt,** production control manager.

Edward H Fisher has been elected president of Tube Reducing Corp, Wallington, NJ. Prior to joining the organization Mr Fisher was associated with the Oliver Corp, Chicago, as vice president and manager of its Special Products Division.

Theodore G Vickers has been named plant manager of the Ross Operating Valve Co, Detroit. He was formerly manager of manufacturing research and development for the Kelsey Hayes Co, Jackson, Mich.

Lindsay Bleakley has been named general manager of the East Chicago (Ind) Machine Tool Corp, contract manufacturer for heavy industry. He has been a member of the firm since 1950.

T J Andersen has been named manufacturing manager of the Dodge Truck plant. He was formerly administrative assistant to the president of Dodge Division. **E W Engel** has been appointed production control manager for the Division. **Charles C Mezey** has been named manager of the Nine Mile Press plant of Chrysler Corp's Stamping Division. **V P Masi,** formerly manufacturing manager of the Mound Road Engine plant, has been appointed manager of the Joseph Campau Engine plant of the Engine Division. **W R Gerber,** formerly general superintendent of the pressed steel division at the Dodge Main plant, has been named manager of the Conant Stamping plant of the Stamping Division.

J Russell Duncan, formerly a vice president of Consolidated Foundries & Manufacturing Corp, has been elected president and chief executive officer of Minneapolis-Moline Co, Hopkins, Minn. He succeeds **Henry S Reddig** who has resigned.

Paul A Christenson has been promoted from production manager to works manager of Square D Co's Industrial Controller Division, Milwaukee.

Laird Anderson has been named manager of manufacturing planning and production engineering of Edsel Division of Ford Motor Co. Mr Anderson joined Edsel (then known as Special Products Division) in April 1956 to establish the manufacturing liaison department.

William J McGraw, electric tool sales manager of Thor Power Tool Co, Chicago, has been appointed general sales manager of all tool divisions

Wayne J Neagles has been named general sales manager of Turchan Follower Machine Co, Dearborn, Mich. He moves up from the post of sales engineer

OBITUARIES

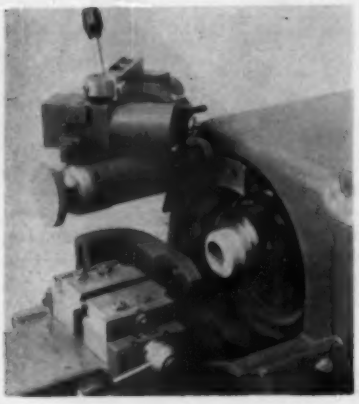
Frank J Nevins, 78, former owner and president of the O K Tool Co, New York and Shelton, Conn, died Nov 24.

Thomas Robins, 89, founder and former board chairman of Hewitt-Robins, Inc, died Nov 4.

F Hughes Moyer, 81, associated for many years with the iron and steel industry, and a former president of Mackintosh-Hemphill Co, Pittsburgh, died Nov 19 in Sturgis, Mich.

NEW SHOP EQUIPMENT

Spiropoint drill sharpener



Close-up of grinding head

Drill Sharpening Machine Grinds Spiral Point on Twist Drills

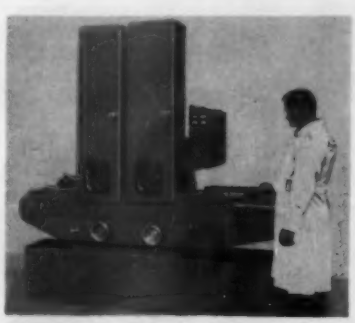
This new drill grinding machine, called the Spiropoint Drill Sharpener, is designed to grind the newly developed (*AM*—Oct 21 '57, p194) spiral point on standard twist drills. It will grind quickly, accurately and economically.

The drill is held stationary and the generating system gyrates around the drill axis to produce the desired shape on the end of the drill. An adjustable truing device is provided for dressing the small tubular grinding wheel so that the point angle of the drill may be varied from about 90° to 180°. The machine is built in two sizes, Model 500 to accommodate drills from ⅛ to ½-in. dia, and Model 750 for drills from ⅛ to ¾ in. An attachment is available which enables both models to grind from No. 60 (0.040 in.) to ⅛-in. drills.

In operation, the drill is placed between vise jaws on the advancing slide of the machine, then located against a retractable stop, and clamped in place. It is then advanced so as to engage the continuously gyrating wheel which is mounted in a rotatable carrier. The correct combination of radial and axial motions for the size of drill being sharpened is set automatically in the machine by a dial-indicated adjustment located on top of the unit. An adjacent smaller dial provides adjustment for values of relief above or below the standard amount in order to meet special requirements. Cost of grinding the new point is said to be no higher than for grinding the conventional chisel point.

Drills ground to the new design last longer; produce rounder, straighter, on-size holes; require no center punching; require less thrust force; reduce workpiece distortion; maintain hole-positioning accuracy; save reaming in many cases; and yield burr-free holes in sheet metal. Illustrated bulletin available on request.

Cincinnati Lathe & Tool Co, Cincinnati 9, Ohio

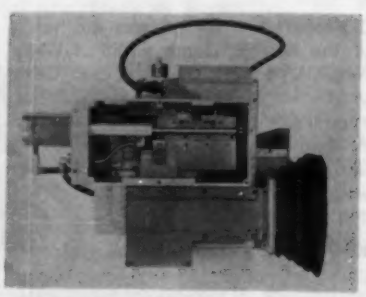


Abrasive Belt Finisher Grinds, Polishes and Deburrs Flat Work

Model FF-6 Flat Finisher is built for wet abrasive belt grinding, polishing, and deburring of flat work such as sheets, strips, bars, stampings, and plates up to 6 in. wide by 6 in. high. Machine is available with single or multiple heads. Belts are carried by two rolls—a powered contact roll and a tracking idler. Vertical adjustment is manually controlled; tensioning on the idler roll is maintained by adjustable air pressure. Head motors up to 7½ hp are available.

An electro-magnetic platen is used to hold material on belt. Magnetic force is adjustable to suit size or mass of the work. Hold down rollers are used for non-magnetic material. Spray, mist, fog and splash are trapped by metal enclosures around each head to insure a clean, dry work area.

Hammond Machinery Builders, 1618 Douglas Ave, Kalamazoo, Mich



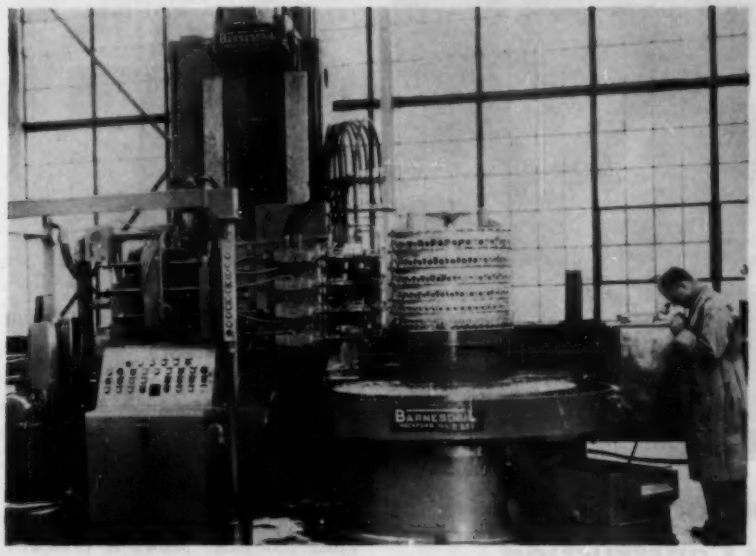
Contour Wheel Dresser Features Automatic, Hydraulic Operation

Model 89 hydraulic contour wheel dresser offers automatic operation with dressing accuracies to within a tenth. Designed for use with cylindrical grinders, unit will dress any angle on the wheel perpendicular as well as horizontal. If necessary, it can undercut grinding wheels and can dress at uniform peripheral speeds. Automatic downfeed and optional automatic crossfeed compensate for wheel wear in two planes.

Dresser is available with precision computed templets for profile widths up to 6 in. and profile depths up to 3½ in. It employs an inclined plane cam reduction mechanism. Illustration shows unit with cover removed, showing templets and mechanism. Bulletin available.

Hogland Engineering & Mfg Co, Inc, 343 Snyder Ave, Berkeley Heights, NJ

MATERIALS AND PARTS



Barnesdril 4-Spindle Boring Machine Is Numerically Controlled

Designed to work on the periphery of cylindrically shaped parts with max diameters of 50 in. and max heights of 40 in., this numerically controlled boring, milling and drilling machine utilizes four spindles selected for four operations by punched tape. The operator locates the part in the fixture by means of an alignment telescope focused on the dividing line of the part and starts the cycle. Upon completion of operations of finish bore, and generating front face and back counterbore, the operator removes the part. At no time is he required to change tools or to make adjustments.

This particular machine is designed to put 248 holes into a compressor casing. Holes are of three different sizes and require three different operations. All positioning of machine motions as well as operator and machine instructions are done simultaneously and from information punched in the tape.

Machine is equipped with a 4-spindle boring head mounted to a compound slide. Head consists of one precision boring spindle and three hydraulically actuated precision feed-out quill and spindle assemblies. These are individually controlled for three different feed-out ratios. Driven by a 1-hp motor, the vertical motion of the spindle is 60 ipm.

The 55-in. rotary table will index through 360° at a speed of approx 5/6 rpm. Machine will maintain an accuracy of 0.005 in. true position and repeatability of ± 0.001 in.

The control unit was built by General Electric's Specialty Control Dept at Waynesboro, Va.

Eight-channel punched paper tape directs rotary and vertical motions for drilling, spotfacing, boring, reaming, tapping and chamfering. Control actuates the machining cycle and performs seven programmed functions: selection of one or both of the motions to be positioned, one of four spindle advances, one of four spindle speeds, one of two spindle feeds, one of three depth selections, position only or drill, and one of four dwell, no-dwell, and backfeed combinations.

Test results indicate that the new machine, which is to be delivered to GE's Aircraft Gas Turbine Div for work on J79 and CJ-805 jet engines, will reduce setup and machining time by about 74%. Design and controls are similar to earlier machine (*AM*—May 6, '57, p172).

Barnes Drill Co, Rockford, Ill

including...

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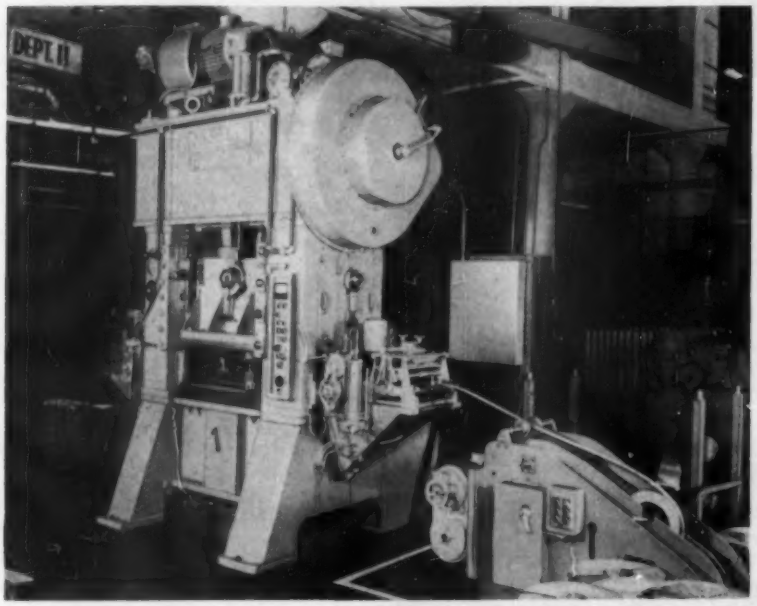
Battery-Operated Fork Lift 176
Die Handling Truck 178



Niagara High Production Presses Feature Extra-Heavy Construction

New line of two-point straight side presses, known as Series SA-2 Automatics, is designed to perform a wide variety of blanking, forming, drawing, and perforating operations in long or short runs. Built with shaft diameters from 4½ to 9 in., units are available in capacities from 60 to 200 tons (non-geared), and 75 to 300 tons (geared models).

The all-steel Niagara Automatic, built to withstand higher speeds and continuous operation, is heavier and more massive throughout than adapted straight side presses of conventional design. Entire drive mechanism—crankshaft, crankpins, gears, clutch, flywheel, and motor—is heavier for added strength and rigidity. Extra bearings give better support to crankshaft, feed take-off, and main gear. Rigid, extra-reinforced, box-type slide is fully contained in the square, extra-long gibbing during working portion of the stroke. All bearing surfaces are lubricated by an automatic circulating oil system.

Automatic feed, mated to the press, permits coil stock to be fed at speeds up to 100 fpm. A Niagara patented roll-lifting system is built into the press for independent, infinite adjustment of ingoing-outgoing rolls from floor level.

Electro-pneumatic friction clutch operates directly on the crankshaft. There are neither gears nor high-speed shafts to start or stop at each engagement. Operating controls incorporate latest safeguards against injury to personnel or damage to the press. Details in Bulletin 264.

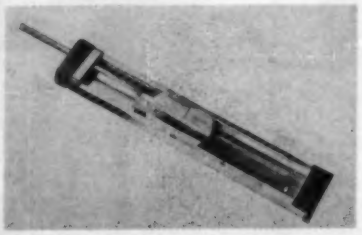
Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY

Lowcost, 3-ft Radial Drill Offers 16 Spindle Speeds

This new, improved, Veet 3-ft radial drill has a glass-hard alloy column, and hardened way inserts on the head and arm. A single lever arm clamp locks arm to column. Drive gears have been widened to carry increased loads.

Sixteen spindle speeds are provided to cover a wide range of work. Capacity under the spindle is 36 in. in the standard model; a floor-level base model provides 52 in. under the spindle; a double-end base model provides 62 in. capacity. Price of the standard model is $3370. Bulletin available on request.

Veet Industries, East Detroit, Mich

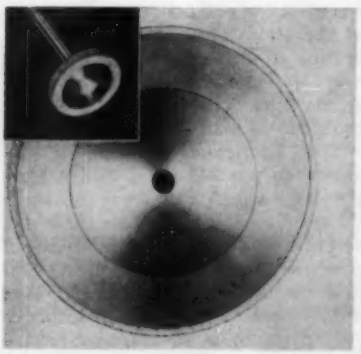


Device Computes Cam Cut-Down For B&S Automatics

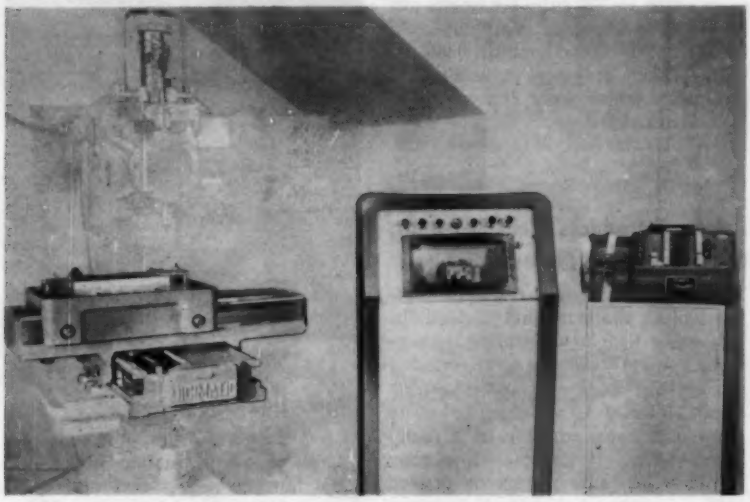
Slide-rule-type computer, called Cam-Puter, is designed for engineers, draftsmen, price estimators and cam layout men. It gives the proper amount of cam cut-down instantly and accurately; shows if and by how much turret tool clears bar end when indexing; shows if cam cut-down alone, or screw adjustment alone, or combination of both is needed. The device also indicates how much the screw adjustment and cut-down influence length capacity; determines pin length capacity; helps the price estimator determine factors that change time cycle and machine size required.

Instrument fits all three machines —00G, 0G and 2G. Separate instruments are available for each machine, if so desired.

Connecticut Automatic Methods Co, Naugatuck, Conn



DIAMOND COATED SAWS are specially designed for cutting all types of reinforced plastics. They are available in over 100 types, both mounted and unmounted, in diameters up to 24 in.—*O'Rourke Diamond Co, Inc, 11423 Van Owen St, North Hollywood, Calif*



Electronic Control System Permits One Drillpress to do Work of Five

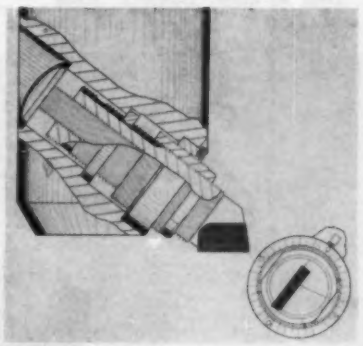
Electronic control system, called the Digimatic Model C-202 Point Positioner, enables one drillpress to do the work of five. System consists of three separate units—a punched tape preparation unit, a pushbutton operated tape reader and control unit, and a compound servo table which positions the work under the desired size drill. The table is operated automatically by the punched tape control unit.

System operates on the closed servo loop principle, which automatically checks back on table positioning to insure absolutely correct hole location. The machine can be run through the same sequence of drills a number of times, each time centering on exactly the same holes. This "absolute positioning" also eliminates error buildup and insures exact repeatability.

High speed operation, simple programming and 0.001-in. accuracy make this unit the equivalent of five standard drillpresses. The self-contained system is applicable for drilling, riveting, spot welding, templet plotting, component insertion or for other positioning applications. Decimal inputs are used; system is economical for one part or for many.

No special tape coding knowledge is required. Decimal coordinates of each hole to be drilled are transferred directly off shop drawing. Operator strikes proper keys for hole position and drill size on the tape preparation unit. The punched tape is fed to the reader and control unit. Control unit translates tape information into electrical impulses that position table and operate the drills. Engineering changes during a production run can be made by inserting the proper holes in the original tape.

Electronic Control Systems, Inc, Subsidiary of General Dynamics Corp, 2136 Westwood Blvd, Los Angeles 25, Calif



Boring Tools are Adaptable to Multiple or Cluster Applications

Boring tools, designated Calibore, have many applications wherever precision boring, turning or other cutting operations are required. Calibore units are easily adapted to multiple or cluster bar applications. With multiple groupings it is possible to machine several related surfaces at the same time with accuracy and a minimum of down time for adjustments.

The tools are available in 26 sizes, covering a wide range of boring diameters, from ¾-in. bore on up. They are made for 53° angle or 90° perpendicular mountings in boring bars.

Cylindrical socket mounting gives high unit rigidity and repetitive accuracy. Adjustment increments are direct reading to 0.0005 in. Units are supplied with HSS tool carriers and can be equipped with tips to match any cutting requirement. Calibore catalog 57 available.

Beaver Tool & Engineering Corp, 500 W County Rd, Gaylord, Mich

Metal Has High Strength, High Wear and Abrasion Resistance

High strength metal called Almanite is reported to possess outstanding wear and abrasion resistance. Combining the best properties of austenitic manganese steel and martensitic white irons, this material can be readily cast in all forms and shapes. No strategic materials are required.

The metallurgical structure suggests that the metal may find extensive use in applications involving heat and corrosion. Certain types of Almanite have tensile strengths of 90,000 psi with ductility in the neighborhood of 15%. Work-hardening characteristics are equal to those of austenitic manganese steel. It can be machined with difficulty using carbide-tipped tools.

Mechanite Metals Corp, 714 North Ave, New Rochelle, NY

Fully Automatic Cutoff Machine Cuts Nonferrous Tubing

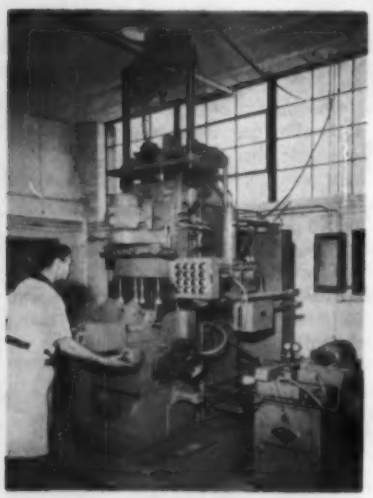
Designed to produce accurate, burr-free lengths of nonferrous tubing at high production rates, this automatic cutoff machine can be equipped with accessories which will permit straightening, tempering, and round-forming of tubing from coiled stock. A hopper feed for tubes up to 20 ft long is also available.

The machine illustrated cuts 2-in. dia, 7-in. lengths of copper tubing at a rate of 2000 pieces per hr. Length

dimension is held to within 0.010 in. The tubing is clamped on each side of the cut to prevent formation of hanging burrs at the breakthrough point. The 12-in.-dia HSS cutoff saw is fed by a hydraulic cylinder in a straight line, thus avoiding gyroscopic forces that would act on the saw blade if it were swung in an arc.

Machine is easily set up, adjustments being provided for speed of cut on saw feed, and length of feed on clamps to control lengths. Feeding and cutoff are automatic. Cut-off piece is ejected as tubing is advanced for next cut. A pushbutton panel controls machine setup and automatic cycle functions.

Walter P Hill, Inc, 22183 Telegraph Rd, Detroit 19, Mich



Multi-Spindle Valve Seat Grinder Is Completely Automatic

Model H-7500 multiple-spindle valve seat grinder, believed to be the first completely automatic machine of its type, can be built to the exact engine and production requirements of the engine manufacturer. It is automated to the extent desired from manual loading and operating to the maximum automatic-cycling transfer operation.

The machine utilizes the "point contact" eccentric valve seat grinding principle. This model is designed for any cylinder head or block with 2, 3, 4, 6, 8, 12 or 16 cylinders and will grind any valve seat material from cast iron through No. 1 Stellite. It is capable of handling wheels of any angle with diameter measurements of ¾ to 3½ in.

Depending on the number of cycles and the degree of automation, the machine can grind the valve seats of 20 to 120 cylinder heads per hr at 100% efficiency. Valve seat accuracy is guaranteed within 0.002 in. TIR. Wheel dressing is automatic; automatic wheel wear compensation is also provided.

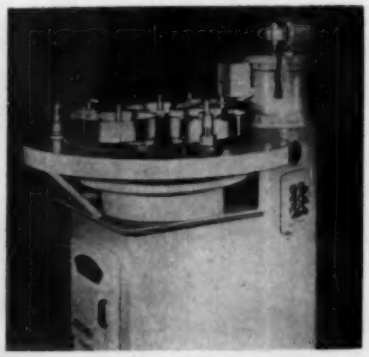
Hall-Toledo, Inc, 2931 South Ave, Toledo 9, Ohio

Devcon Introduces Wear-Resistant, Self-Lubricating Material

Devcon WR is a wear-resistant, self-lubricating material that is used for low speed bearings, building up surfaces subject to severe wear, making duplicating masters and forming dies. Material is supplied in paste form and upon addition of a hardening agent, it becomes a syrupy liquid which can be cast or poured into a variety of shapes. It becomes so hard in two hr that it can be machined only with carbide or similar tools. Tests show that it outwears cold rolled steel 60 to 1. Because of its resistance to most acids, alkalies, solvents and other chemicals, it can be used for lining tanks and for repairing leaking equipment.

Material is supplied in 1, 4 and 15 lb containers and in a trial kit containing four 1-lb cans and the necessary components. Trial kit sells for $11.40.

Devcon Corp, Danvers, Mass

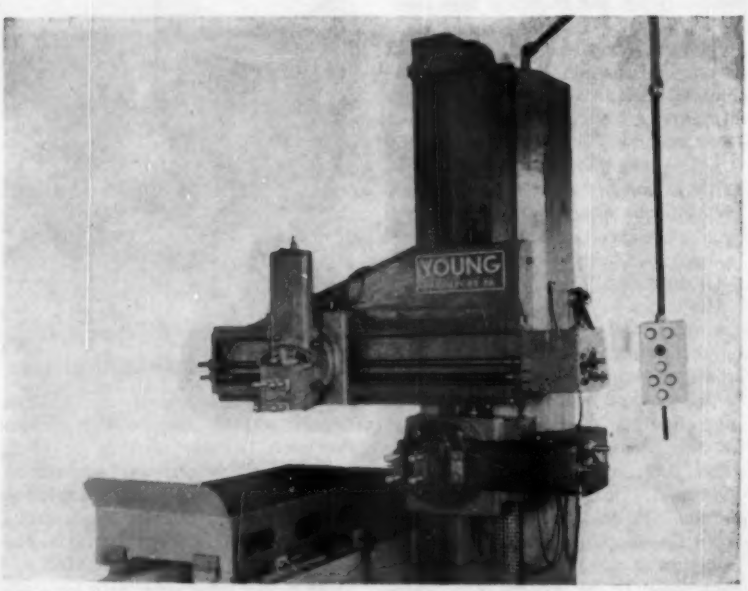


Lapping Machine is Designed for Production Line Lapping

The Gyro-Matic 24 lapping machine, designed for production line precision lapping and finishing of all types of flat parts, features a 24-in.-dia anti-distortion lapping plate. Each of three workholder rings accommodates piece parts up to 9¾-in. dia.

The amount of abrasive can be adjusted to meet specific requirements. Cleaning and refilling of the abrasive tank has been simplified by making the entire unit removable with the loosening of only three screws. As on the earlier models, pushbutton operation is featured.

Spitfire Tool and Machine Co, 2931 N Pulaski Rd, Chicago 41, Ill



OPEN-SIDE PLANER, Model 24 P, has independent side head feeds, automatic cross-rail clamps, rapid traverse to all heads and slides, and force feed lubrication to the ways. Hydraulically driven by 15-hp motor, machine handles workpieces up to 36 in. high and 36 in. wide. All controls are from pendant. Stroke is 6 ft—*Young Testing Machine Co, Young Machine Tool Div, Church Rd, Bridgeport, Penna*

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MACHINES AND ATTACHMENTS

1 MECHANICAL PRESSES—*Clearing Machine Corp, 6499 W 65th St, Chicago 38, Ill.* 48-page catalog 234 covers Series S straight side crankshaft units in capacities from 50 to 300 tons, bed areas from 36 x 24 to 120 x 66 in., available with single end or twin end crank drives, and with standard or enclosed straight side frames.

2 VERTI-SLIDE FOUR-SLIDE MACHINE—*Torrington Manufacturing Co, Machine Division, Torrington, Conn.* 8-page bulletin V-82 illustrates and describes major operating features and specifications of first combination machine, handling both wire and strip, developed and engineered in the US. Design details and component functions given for feed mechanism, cam and cam shafts, drive system, and presses. Includes physical and performance specifications.

3 GRINDING AND BORING SPINDLES—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich.* 8-page illustrated bulletin 25477 gives data on precision spindles; discusses and pictures variety of applications. Covers many standard units for use as original equipment, or as replacement items to improve performance of machines in use.

4 TRACER-CONTROLLED MILLING MACHINES—*Colonial Broach & Machine Co, Colonial-Romulus Division, Parkgrove Station, Detroit 6, Mich.* 4-page illustrated bulletin CRS-57 contains details on hydraulically driven sculpture machines. Application photos indicate uses in aircraft and die work. Units can be used for tracer-controlled contour and profile milling in wide range of metals; speeds are infinitely variable.

5 OBI MECHANICAL GAP PRESSES —*Oliver Corp, A B Farquhar Division, 128 N Duke St, York, Penna.* Illustrated, 4-page bulletin M-100 contains description of units available in 75, 100, 150, and 200-ton capacities.

6 METAL STITCHERS—*Acme Steel Co, 135th St & Perry Ave, Chicago 27, Ill.* 16-page booklet contains data on stitching metal to metal, or metal to nonmetallic materials. Illustrates and describes applications and equipment; gives information on special clinchers available to adapt these machines to any job.

7 HAND SCREW MACHINE—*Rockwell Manufacturing Co, Delta Power Tool Division, 478 N Lexington Ave, Pittsburgh 8, Penna.* 6-page bulletin illustrates and describes unit that has a bed turret with six stations. Explains how standard Delta 11-in. metal lathe may be converted into a hand screw machine by addition of accessories. Gives nine specific examples of parts that can be produced economically on the machine, and production rate on each.

8 42-IN. PLAIN ROTARY TABLE—*Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* Illustrated circular describes automatic indexing unit equipped with numerical control. Planning chart data can be fed into table by punch tape or operator's console. Operational details and specifications included.

9 HYDRAULIC PRESSES — *A Dale Herman, Inc, 17071 Ventura Blvd, Encino, Calif.* 4-page illustrated bulletin describes precision steel units manufactured by King Machine & Mfg Co of Los Angeles. Presses, available in four models (65, 125, 170, and 300-ton capacities) are all built in the same frame; lower capacity presses can be raised to higher capacity later by installation of a kit supplied by King.

TOOLS AND ACCESSORIES

10 SPIRAL POINT DRILLS—*Cincinnati Lathe & Tool Co, 3207 Disney St, Cincinnati 9, Ohio.* 16-page brochure discusses principle and features of spiral point concept in twist drill design as compared with standard chisel point drill. Among advantages claimed: produces rounder, straighter hole, truer to size; in-

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creased drill life; eliminates center punching; reduces drill thrust force as much as 34%; produces less work distortion because of cooler cutting and reduced thrust force; reduces need for secondary operations in many instances; when applied to sheet metal, produces a round, practically burr-free hole. Spiropoint Drill Sharpener for applying process to standard twist drills described and illustrated.

11 HYDRAULIC FLUIDS — *Vickers Inc, Box 302, Detroit 32, Mich.* 24-page bulletin 1300SA deals with selection, operation, and maintenance of hydraulic fluids for industrial machinery. Describes characteristics of petroleum base and fire-resistant products; gives selection and maintenance recommendations; trouble-shooting tips.

12 ELECTRO-PROBE GAGING — *Federal Products Corp, 1144 Eddy St, Providence 1, RI.* 4-page illustrated brochure gives information on electronic test indicator, a portable, dimensional test instrument, and the Sure-Set, an electronic table positioning device for universal grinders. Operating characteristics explained; applications discussed; list of accessories; specifications included.

13 DIE SETS AND ACCESSORIES—*Standard Die Set Co, Division of Harvco Corp, 1595 Elmwood Ave, Providence 7, RI.* 68-page catalog 570 describes series of all-steel precision sets designed to parallel the punch and die classifications established by the ASTE Punch and Die Committee. Committee's three classifications of tools are matched by corresponding die set classifications. New cataloging system lists die sets according to usable die space instead of over-all die set dimensions.

14 UNITIZED TOOLING—*Punch Products Corp, 3300 Highland Ave, Niagara Falls, NY.* 20-page catalog illustrates and describes basic principles of system. Included are tooling cost comparisons, typical setups and mounting methods for presses and press brakes, notched and perforated angles, channels, extrusions and sheets, and standard and special units that comprise unitized tooling.

15 GRINDING WHEELS — *Simonds Worden White Co, 1101 Negley Place, Dayton 7, Ohio.* 16-page catalog covers range of vitrified and resinoid units furnished in standard sizes and shapes, or designed for special requirements. Markings, specifications, recommendations for different types of metals and classes of work to be ground included.

16 OPTICAL COMPARATORS—*Jones & Lamson Machine Co, Springfield, Vt.* 37-page illustrated catalog 5700 discusses and illustrates operational and design features of variety of models. Attachments, special charts, and standard fixtures described; lens data section and machine specifications included.

HEAT TREATING AND WELDING

17 HEAT TREATING UNITS—*Ipsen Industries, Inc, 731 South Main St, Rockford, Ill.* 4-page illustrated brochure describes design and construction features of new 1958 Ipsen Model B.

18 ELECTRIC FURNACES — *Thermo Electric Manufacturing Co, 461 Huff St, Dubuque, Iowa.* 20-page catalog 57 contains illustrated descriptions of Temco line of laboratory and industrial equipment including furnaces, hot plates, temp controllers, pyrometers, flask heaters, and magnetic stirring hot plates.

PARTS AND MATERIALS

19 ULTRA-STRENGTH STEELS — *Climax Molybdenum Co, 500 Fifth Ave, New York 36, NY.* 16-page booklet contains detailed data on structural steels with yield strengths over 200,000 psi. Describes all grades currently available in the US. Technical information and tables give composition and properties; various end uses listed.

20 WORM GEAR DRIVES—*Cone-Drive Gears, Division Michigan Tool Co, 7171 E McNichols Rd, Detorit 12, Mich.* 24-page bulletin CD-200 presents technical information on design and application of double-enveloping worm gearing. Contains detailed engineering formulae and step-by-step instructions for using them in designing and applying Cone-Drive gearing to drives of all types.

21 DIE SPRINGS—*E W Bliss Co, Die Supply Division, 1400 Brookpark Rd, Cleveland 9, Ohio.* 12-page catalog 70-A, Section 4, classifies die springs in 500 standard sizes and three pressure groups for each size. Includes specifications and prices on all of Dieco's packaged spring assortments.

22 PRECISION LIMIT SWITCH—*Micro Switch, Division of Minneapolis-Honeywell Regulator Co, Freeport, Ill.* 4-page illustrated bulletin 20 describes new "Plug-in Limit" switch that can be replaced in seconds with accurate positioning and no required adjustments. All five actuator types available are covered; dimension drawings, mounting information.

MISCELLANEOUS

23 CONTRACT TOOL AND DIE SHOP SERVICE—*Southern Tool & Die Association, PO Box 45283, Airport Station, Los Angeles 45, Calif.* 64-page illustrated brochure, "Service is Our Business," contains tabulation of products and services provided by 80 member firms, statements of policy, and descriptions of individual firms' specialties and facilities.

24 SPECIAL CAMS—*American Cam Co, Inc, PO Box 6106, Hartford, Conn.* 8-page brochure SC-1 describes complete service for providing special cams of every type, either a single piece or production lots of thousands. In addition to illustrations of manufacturing and testing facilities, booklet pictures and discusses some of the special cams designed to meet requirements of the aircraft, guided missile, and electronics industries.

25 PRESS MODERNIZATION—*E W Bliss Co, 1375 Raff Rd, SW, Canton, Ohio.* 16-page illustrated bulletin 45 describes modernization and conversion assemblies for older, obsolete, or worn straight side and gap frame presses. Presents 18 examples of how factory-engineered, plant-installed assembly kits can revitalize older units.

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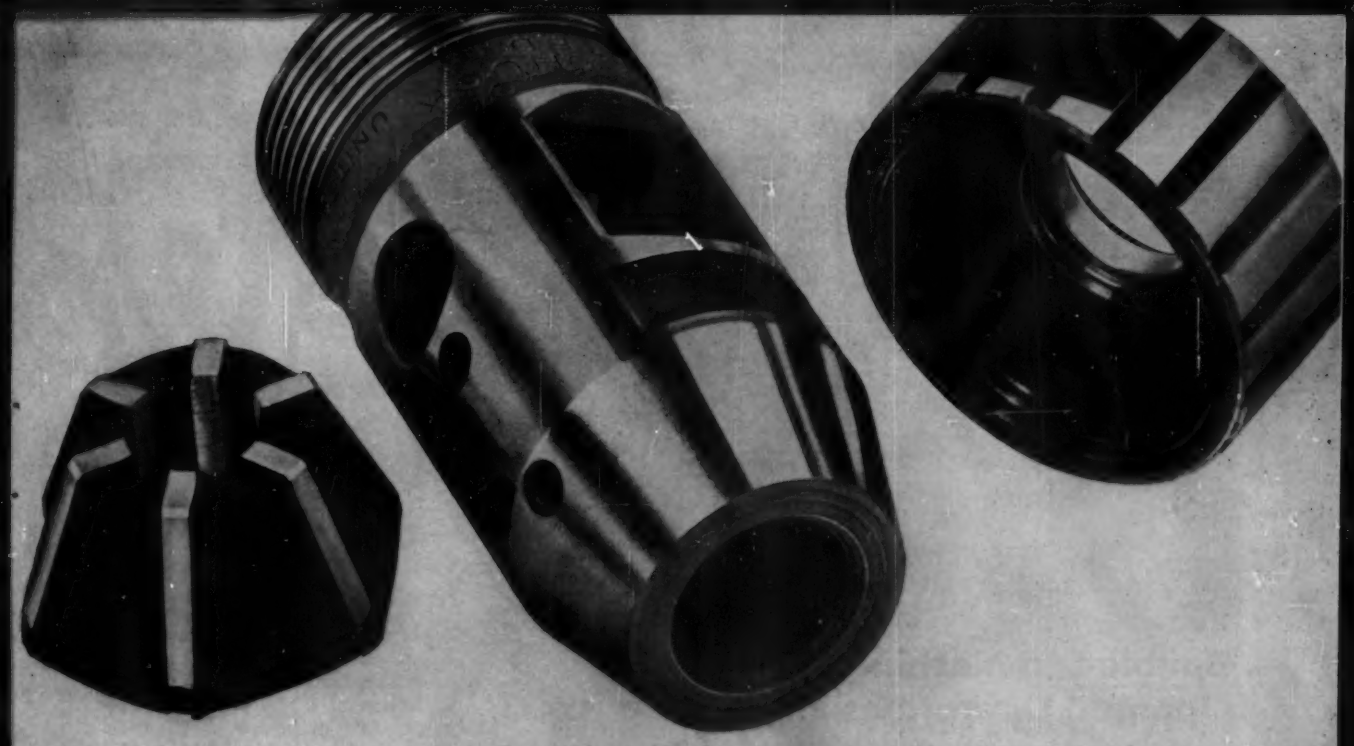

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Superior performance is the result of the painstaking production of superior parts.

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The Jacobs Manufacturing Company
West Hartford, Connecticut

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Rubber-Flex® Tap Chuck designed for tapping heads and impact tools.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

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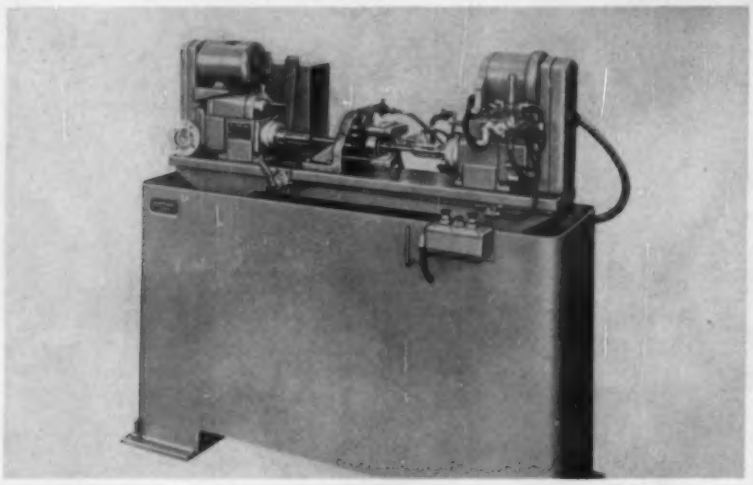


Double-End Machine Performs Opposed Operations Simultaneously

Designed to perform opposed operations simultaneously, this machine may be used with a small index table, manual or air-clamp fixtures, hopper or vibratory feeders, and is available with either manual or automatic interlocked cycle. Parts up to 28 in. long can be drilled, centered, spotfaced, chamfered, reamed, tapped, threaded, hollow milled or bored. It is also adaptable to multiple head operations and will perform two operations per hole when fitted with an index table.

In the illustration, machine is equipped with two hydraulic drill units which provide a drilling capacity of 5/16-in. dia in mild steel. Tapping capacity is ⅜ in. With a max stroke of 1½ in., spindle speed range is 300 to 10,000 rpm and the feed range is 0 to 70 ipm. Rapid approach rate is 350 ipm; rapid return rate, 300 ipm.

Machines are available completely assembled or as separate components. Base, which is equipped with a coolant tank and pump, is 40 in. high, 22 in. wide and 65 in. long.

Hartford Special Machinery Co, Hartford 12, Conn

Alloy is Suited for Resistance Heating Applications

Iron-chromium-aluminum alloy, designated Alloy 815, is said to be suited for moderately high temperature resistance heating applications such as small appliances, and for industrial heating devices where continuous operating temperatures do not exceed 2150 F.

Important properties of this alloy, which is free of all critical raw materials, include a resistivity of 815 ohms per circular mil ft at 68 F, low specific gravity, and exceptionally high resistance to oxidation. Other uses include "cold" resistor applications such as defroster units, contact switches and rheostats. In addition, its high ductility makes it suitable for applications requiring considerable cold forming.

Hoskins Mfg Co, 4445 Lawton Ave, Detroit 8, Mich

Atrax Introduces Series of Solid-Carbide Chucking Reamers

New 1564-R series consists of 21 tools, ranging in diameter from 1/16 to ⅜-in. dia. These right-hand spiral reamers feature straight shank, precision ground lands, radius chamfer and right-hand cutting. Sizes 1/16 through ¼ in. are 4 flute; from 7/16 through ⅜ in. are 6 flute. Tolerances on the reamer diameter are +0.0002 in., –0.0000 in.; on the shank diameter, +0.0005 in., –0.0005 in.

Atrax Co, 240 Day St, Newington, Conn

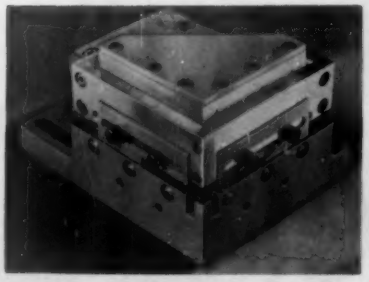
Yale & Towne Triplex Mast Permits Extra High Stacking

Triplex mast design features three, nested, I-beam lifting members which are raised hydraulically by the action of a multi-stage lift cylinder. This cylinder operation requires only two single-lift chains leaving the rest of the space between cylinder and uprights open to give increased visibility.

These chains work on a single pair of sheaves to transmit power to mast. This design compares with other methods of either reeving much longer chains over four pairs of sheaves or the use of two pairs of chains on two pairs of sheaves requiring an extra set of channels to achieve triple lift.

The Triplex mast is offered in standard heights of 59, 71, 83, 90 and 96 in. which give max fork heights of 108, 144, 180, 198 and 210 in. respectively. Applicable to all Yale electric and gas powered trucks, mast is being offered initially in 3000, 4000 and 5000-lb capacities.

Yale & Towne Mfg Co, Yale Materials Handling Div, 11000 Roosevelt Blvd, Philadelphia 15, Penna



Notching Unit Has Removable, Reversible Punch and Die Blades

The new NA ¾-in. 90° corner notching unit features removable, reversible punch and die blades. The short

Boring operation on 24" aluminum microwave component. Note complicated set-up made simple with HURTH tiltable worktable. Deep throat of machine saves set-up time . . . saves cutters, too.

PHOTOGRAPHED AT L. H. TERPENING CO.

can you match these savings . . . in your boring and milling operations?

Close tolerance boring in gear box housing. Note optical reading devices at right.

65% saving in set-up and production time at RAYTHEON

"The HURTH V10a performs both jig boring and milling operations that would cost us three times as much on other type equipment. We find it flexible for short runs and equally reliable and consistent for long runs."

says Albert Waldstein, Mgr., Machine Design and Fabrication, RAYTHEON MANUFACTURING CO.

25-50% saving in toolroom and small lot production at TERPENING

"The HURTH V10a cut our jig boring and milling time up to 50% compared to equipment formerly used. It's the first machine we turn to for close-limit tooling and small lot production and it does work not possible on our other machines. In jig boring with the HURTH, we locate and size holes within .0002"."

says E. J. Friebele, Chief Engineer, L. H. TERPENING CO.

Both agree—as do all other HURTH users—that there's no precision tool so economical to run when complicated set-ups with many tool changes are required. For the HURTH combines vertical milling, downfeed milling and jig boring in one machine—performs these *three different operations* to close tolerances with *one* set-up of the work. Large optical reading devices facilitate quick, accurate coordinate settings. You merely change table settings and cutting tools for:

VERTICAL MILLING—using longitudinal traverse of worktable, which can be tilted 15° to front or rear.

DOWNFEED MILLING—using longitudinal traverse of worktable and graduated downfeed of cutting spindle.

JIG BORING—using continuous spindle downfeed, varied in extremely small steps.

Match the savings other HURTH users are getting—in your toolroom—on your production line. Talk it over with one of our sales engineers. Write for details.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN COMPANY, INC.

36 Exchange Place, Jersey City 2, N. J. • In Canada: 2490 Eglinton Ave. W, Toronto

¾-in. dimension from cutting edge to outside face of unit permits close positioning to other units in setup. Punch and die blades are each in two segments which can be interchanged, reversed, turned end-for-end and top-to-bottom to present eight cutting edges before regrinding is necessary.

Units are made in 3 x 3 in. and 5 x 5 in. sizes, right or left hand, with or without adjustable side gage plates or built-in graduated gage table. Capacity is ⅛-in. mild steel. Mounting can be done outside the press on mounting templets, T-slotted mounting plates or rails. Nothing is fastened to the ram. Shut height is 5½ in.

Wales-Strippit Co, Akron, Ohio

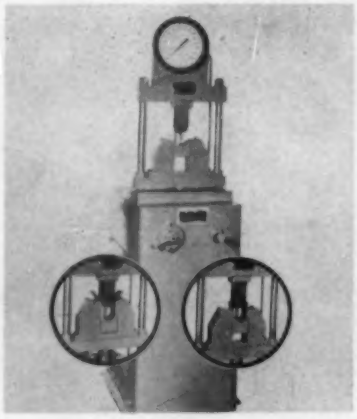
Standard Feeder Unit Feeds Heavy Flat Strip Stock to Presses

Portable automatic unit for feeding heavy flat strip stock to presses is designed to handle thicknesses beyond the capacity of conventional roll feeds and straighteners. This plug-in unit can be adapted to either single-operation or progressive dies.

Stock is rolled manually into a preload station and automatically lowered to a feeding station by air-cylinder-controlled arms. The sheet of strip stock is fed into press by a reciprocating mechanism with mechanical grippers. Stroke of the feed mechanism is adjustable to meet a variety of applications.

Electrical controls in the unit permit it to be tied into the press cycle to provide a fully automatic feeder arrangement. Feeder is about 6 ft high and 3 ft wide. Over-all length depends upon lengths of strip stock to be handled.

Press Automation Systems, Inc, 25418 Ryan Rd, Centerline, Mich



Guided Bend Testing Machine Tests Butt-Welded Samples

Designed to test butt-welded samples in accordance with the qualification procedure of the AWS and the ASME, the Model GB-124 testing machine can be run by an unskilled operator without difficulty.

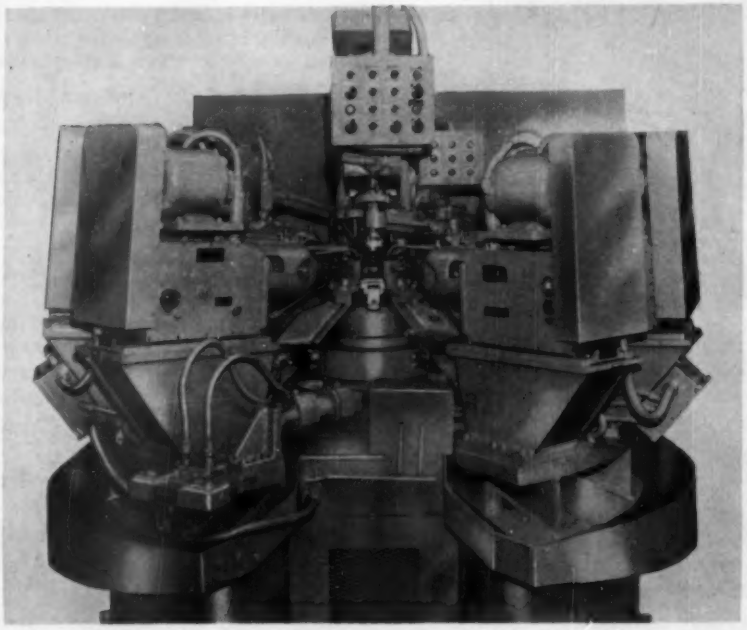
Machine has its own hydraulic load-applying means, and is designed so that different fixtures for different thicknesses of metal can be quickly and easily interchanged. Tester is 70 in. high, occupies a floor space of approx 13 x 24 in., has 15,000 lb capacity, and has a ½-hp motor. Two hydraulic valves control pressure and direction of piston travel.

Steel City Testing Machines, Inc, 8817 Lyndon Ave, Detroit 38, Mich

Drilling Unit Has ¼-in. Drill Capacity and 1½-in. Stroke

Lowcost pneumatic drilling unit uses a double-acting cylinder to provide reciprocating motion. With units of this type, manufacturer claims that it is now practical to develop low-cost special units to drill, countersink and deburr for small as well as large quantity production. The standard model has a ¼-in. drill capacity and a 1½-in. stroke. A micrometer stop is incorporated to give positive depth control. Price is reported to be under $100.

Model Machine Co, Inc, 4729 Hawthorne St, Philadelphia 24, Penna



ALUMINUM PISTONS are processed on this machine consisting of nine No. 1 Avey automatic cam feed drilling units and one indexing table. Nine holes are drilled at one time; table indexes 15° and seven more holes are drilled. Table then indexes 180° and operations are repeated on the opposite side of the piston. Drilling and indexing operations are automatic. Production is 85 parts per hr—*Motch & Merryweather Machinery Co, Avey Div, Cincinnati 1, Ohio*

4 OF THE MANY STYLES OF THE ONE-PIECE SEAMLESS DOOR KNOBS FABRICATED FROM RUGGED REVERE BRASS STRIP.

REVERE BRASS STRIP Stands the Gaff!

The one-piece door knobs shown are drawn from a single blank of Revere Brass Strip, presenting an attractively smooth, unbroken surface without the need for seams or welds.

Because they are made by a unique procedure the manufacturer tells us that the brass must stand up under mighty rugged going, and that to produce the quality knobs they do, at an economical production level, the brass they use must have:

1. *Uniformity of gauge.*
2. *Absence of any sign of fracture or crimping when drawn.*
3. *Consistently correct grain structure to insure a smooth, flaw-free surface on the finished knobs.*

The manufacturer also tells us that Revere Brass Strip has been filling that bill, with utmost satisfaction, for some time.

Revere Brass Strip may be able to help *you* make a better product at less cost. You'll never know until you talk it over with one of our TA's (Technical Advisor). There's no obligation, of course. And such a discussion could save you a substantial sum of money. Such has been the case many, many times.

COPPER ★ BRASS ★ 18 01 ★ REVERE ★ ALUMINUM

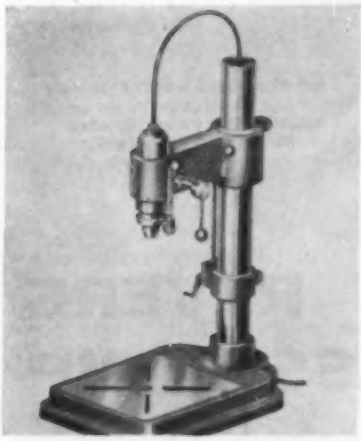
REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

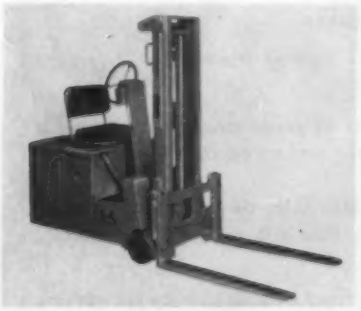


Bench-Type Air-Powered Riveter Operates at 5000 spm

This multi-purpose, air-powered unit is designed for riveting, peening, swaging, milling and cutting. Machine starts and stops automatically when work is brought into contact or removed from contact with the hammering point. Adjustments are reported to be so fine that tool can be used for precision work. Stroke can be adjusted to work inside recessed pieces.

Machine operates at 5000 spm with air pressure up to 100 lb; consumption is 4 cfm. An air pressure adjustment allows machine to operate on pressure as low as 10 lb. Total weight is about 95 lb. Unit measures 3 ft high, 19 in. deep, and 1 ft wide.

Industrial Control Products Inc, Caldwell, NJ

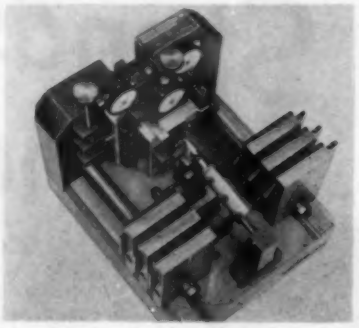


Electric Fork Lift Truck Added To Lewis-Shepard Line

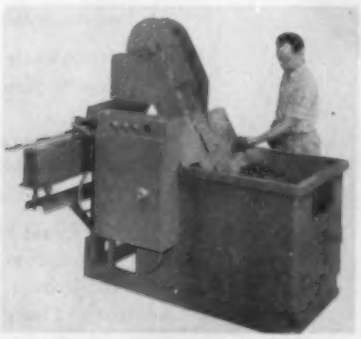
This electric fork lift truck, Model H, features 24-v electrical system, and is particularly suited to situations requiring continuous operation and frequent stopping and starting. It is a rider-type truck driven from a sitting position. It has a turning radius of 56¼ in. and can stack goods in aisles as small as 9¼ ft wide, when carrying a 48-in.-long load.

Truck is available in any of four standard capacities—1000, 1500, 2000 and 2500 lb. Collapsed heights on all units are either 68 or 83 in., with 102 or 132-in. fork elevations. Other features of the 2500-lb-capacity model include lift speed of 50 fpm empty and 33 fpm loaded, traction speeds of 5 mph empty and 4.25 mph loaded. Truck has three speeds in both forward and reverse. There are two separate braking systems, dynamic braking and a deadman-type brake.

Lewis-Shepard Products, Inc, 125 Walnut St, Watertown 72, Mass



JET ENGINE BLADES are checked for accuracy in this universal gage which can handle a variety of blade forms and lengths. Templet holders are positioned by interchangeable master gage bars. Templets engage foil section of blade to indicate form accuracy as well as blade tilt and bow—*Shepard & Young Tool Co, 15150 Telegraph Rd, Detroit 39, Mich*

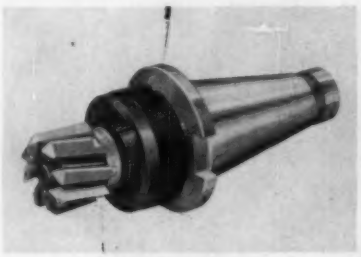


Orienting Storage Feeders Handle Medium to Large Parts

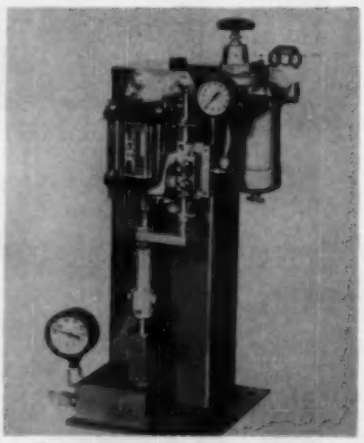
Units will store, elevate, orient and feed parts having over-all dimensions of from ⅛ x ⅛ x ¼ in. to parts as large as 3 x 6 x 10 in. Storage capacities of 5, 10 and 20 cu ft are available.

Parts may be fed at rates up to 300 pieces per hr. A single feeder may be tooled to feed a family of parts. Natural frequency feeding principle delivers the parts under power to the machine being fed and eliminates the need for a gravity feed track. Unit illustrated is a 5-cu-ft model designed to feed a centerless grinder.

Campbell Machines Co, 18634 Fitzpatrick, Detroit 28, Mich



QUICK-CHANGE HOLDER, designated Kwik-Switch, is designed for heavy cutting in die sinking and similar operations. The 3-piece device provides positive square drive, back-up screw stop and depth adjustment. A collet-type adapter, designed for presetting, is furnished with the holder—*Universal Engineering Co, Frankenmuth, Mich*



Air-to-Hydraulic Convertor Is Entirely Air Operated

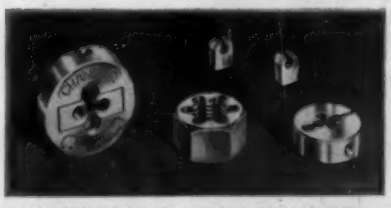
Automatic air-to-hydraulic convertor is entirely air operated—no electrical connections are necessary. It incorporates company's Renco-Aire micro-valve air motor and a highly efficient hydraulic pump and reservoir. The variable stroke pump is instantly adaptable to any hydraulic re-

PLASTIC TAP BOXES

COMPLETE LINE OF STANDARD & SPECIAL TAPS

PROTECTED QUALITY

It's apparent how Threadwell TAP quality is protected by the original plastic tap package shown above. BUT . . . the quality of ALL Threadwell products is ***triple protected.*** At the ***factory*** by rigid process and individual final inspection . . . In ***transit and storage*** by advanced packaging and clear labeling . . . and in ***use*** by Threadwell Field Engineers strategically located nation wide to help you with cutting tool and gaging problems on the job.



ADJUSTABLE ROUND, 2-PIECE & HEXAGON DIES

KEYWAY BROACHES & SETS

COMPLETE LINE OF HIGHEST PRECISION GAGES

THREADWELL DISTRIBUTORS, too, are strategically located to serve you promptly, properly, and well.

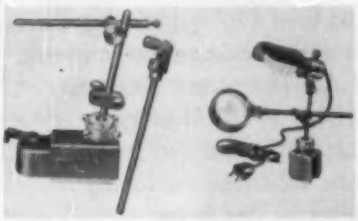
THE FINEST IN CUTTING TOOLS & GAGES

quirement. It instantly takes up any loss in hydraulic line pressure, automatically and silently.

Unit will operate at air pressures as low as 5 psi to a max of 100 psi, providing hydraulic pressures of from 0 to 10,000 psi. Hydraulic accuracy of 1/10 of 1% can be maintained.

Five standard models cover a complete range of hydraulic requirements. Double-acting models and larger units rated to 30,000 psi output are available.

Renco-Toledo, Inc, 3358 W Alexis Rd, Toledo 13, Ohio



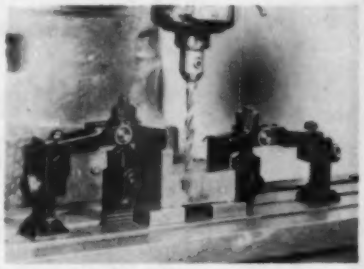
MAGNETIC-BASE TOOL, called the Magnicator Junior, comes in two sizes, with a variety of accessory dial indicators, lights, and magnifiers. Blue plastic magnetic bases can be turned on and off by fast-action switch. Magnetic strength of larger model reaches 125 lb. Smaller model can be mounted on surfaces as small as ¾-in. dia—*Brown & Sharpe Mfg Co, Providence, RI*

Miter Gage for Carbide Tool Grinders Allows 180° Positioning

New tool called the Angle-Set miter gage is designed for use on tilt tables of carbide tool grinders. It can position tools at extremely small or large angles while sharpening. It can be assembled in four different positions to give a complete 180° selection of tool rest positions as indicated on the calibrated 90° sector dial.

Adjustable springs hold the movable face plate in position either towards or away from the wheel face. It can be bought separately or as standard equipment on company's Coolie-Grinderlap carbide tool grinder.

Diamond Tool Co, Box 32, South Haven, Mich



STRAP CLAMP ASSEMBLIES, tradenamed Hi-Lo, are available with clamping capacities of ⅞ to 2¼ and 2⅜ to 4⅞ in. They are available with interchangeable T-bolt or stud bolt assemblies, and feature a ¼-turn serration lock that provides quick, accurate adjustment—*Hi-Lo Products Co, Div of Steel City Testing Machines, Inc, 8817 Lyndon Ave, Detroit 38, Mich*

Machine Sharpens Circular Metal-Cutting Saws up to 14-in. Dia

Machine automatically sharpens all circular metal-cutting saws from ½ to 14-in. diameter, from the finest teeth up to 2 teeth per in. It may be used for all steels, brass, copper, bronze, aluminum and plastics. Arbors are supplied for hole sizes from ¼ to 1-in. dia.

The indexing system permits the cutting of new teeth or changing the number of teeth on a blade. It is also possible to sharpen up to 6 or 7 saws at one time. Literature available.

Hamco Machines, Dept A, 97 Mt Hope Ave, Rochester 20, NY

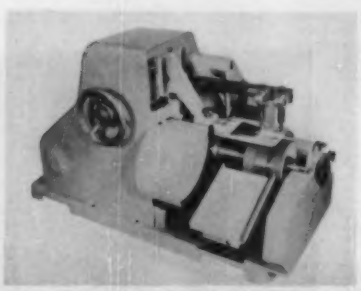
Crown Adds Three Models to Line Of Battery Operated Fork Lifts

Three new models have been added to company's line of portable, battery operated fork lift trucks. Each is rated at 1500-lb lifting capacity. Fluid is pumped into a lifting cylinder which, in turn, raises load to any desired height between 56 and 76 in. depending on the model.

Lifting and lowering are controlled by a single throttle-type control affording extreme accuracy. Foot-operated floor locks are located on either side of chassis. Specifications include lowered height of 4¼ in., over-all width of 24 in., straddle capacity of 16 in., and a weight of 460 to 485 lb depending on model.

Other features include lifting speed of 35 fpm, 20-in. load centers, hard-rubber roller-bearing wheels and casters.

Crown Controls Co, Inc, New Bremen, Ohio



Marking Machine for Cylindrical Parts Features Rapid Type Change

Offset marking machine, Markem Model PAM-AG, is designed for short-run marking of cylindrical objects. It uses a master plate and removable type inserts instead of a rubber printing plate or type lock-

Look to Skinner in '58

for NEW answers to your control "puzzles"

Coming soon — several completely new solenoid valve lines loaded with such features as...

- **Lower prices**
- **Greater capacities** • **Higher pressures**
- **Long life expectancy—millions of cycles**
- **Diversified applications**
- **Wide selection of media handling**

And these are but a few of the many new advantages of Skinner's new solenoid valves. As always, of course, they'll be strictly manufactured to Skinner's highest-quality engineering standards.

Look for the announcements of Skinner's new valve lines in these pages throughout 1958. For advance information, write Dept. 30D.

Most important, these new valves will give you performance and applications that heretofore have not been possible!

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION

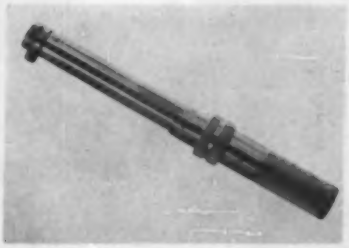
NEW BRITAIN CONNECTICUT

105 EDGEWOOD AVENUE

NEW SHOP EQUIPMENT, MATERIALS, AND PARTS

up, allowing quick type change. This bench-mounted model employs interchangeable workholding fixtures to handle various cylindrical, tapered, conical, or wire lead objects, ⅛ to 2½ in. in dia, that cannot be chute fed. Max imprint area is 3 x 2¾ in. Recommended operating speed is 50 to 60 parts per min, but rate is adjustable to suit operator. Ejection of marked parts is automatic.

Markem Machine Co, Keene 82, NH

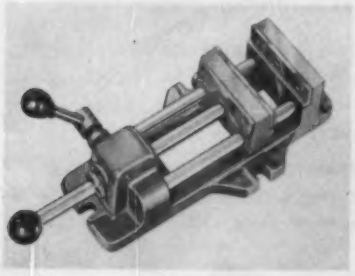


Torque-Indicating Tool Operates In Either Direction

Designated the MC 150 Micro-Set, this torque indicating tool can torque screws, volts or nuts in either direction with high accuracy. It measures only 1 in. or less at the drive head and is suited for operation in tight quarters. A micrometer-type setting in the handle releases automatically at the desired tension and the tool resets itself after release.

Tool is easily assembled or disassembled without special tools. It is available in three sizes: 5 to 150 in.-lb, 100 to 750 in.-lb, and 700 to 1600 in.-lb.

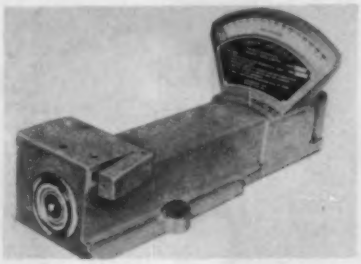
Apco Mossberg Co, Lamb St, Attleboro, Mass



Drillpress Vise Handles Both Rigid and Non-Rigid Work

Drillpress vise, designated the Adjusto-Quick Control, exerts a jaw pressure of from 1 to 1500 lb. Pressure is adjusted by turning the front adjusting screw bushing. The heavy, 4-in.-wide removable jaw inserts allow simple, quick changeover to low cost jigs and fixtures. Max opening is 5½ in. Hand pressure on locking lever locks and holds work fast. Literature available.

L-W Chuck Co, 26 South Saint Clair St, Toledo 4, Ohio



Wide-Range Torque Analyzer Checks Power Screwdrivers

Model P-15 analyzer utilizes a torsion bar with a dampening effect. The needle indicator remains at the torque value reading until operator presses a release bar. Unit weighs 20 lb, measures 5 in. wide, 18 in. long and 8 in. high. Dial length is 7 in.; drive is a 5/16-in. male hex. Capacity is 0 to 150 in.-lb. A dead-weight test wheel is furnished with the instrument.

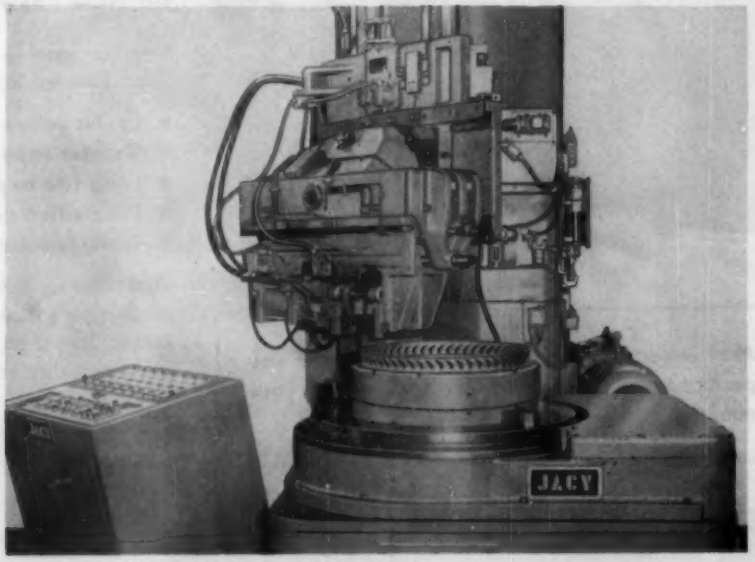
Distributed by Richmont Inc, 922 S Myrtle Ave, Monrovia, Calif

Lewis-Shepard Introduces Truck For Handling Dies up to 7500 lb

Electrically powered JackStacker walkie materials handling truck is specially designed to handle dies weighing as much as 7500 lb. The platform-type truck, which is equipped with a hydraulic pusher and puller, can high stack dies in storage racks, as well as transport and place them directly in the press.

Operated from a control handle, this truck has a 42-in.-long, 32-in.-wide platform. Horizontal stroke of the pusher-puller is 42 in. Truck will operate in aisles as little as 7 ft wide. It has a platform elevation of 54 in.

Lewis-Shepard Products, Inc, Dept R-20, 125 Walnut St, Watertown 72, Mass



ANNULAR RINGS in sizes from 16 to 54-in. dia are formed or perforated on this Jacy index and pierce machine, which is available in sizes up to 65 tons. The index table features infinite resolution from one to 21,600 divisions of a circle. Electronic console houses manual and pushbutton controls. Table is available in diameters of 18, 24, 36 and 45 in. with either electric or hydraulic drive—*Modern Engineering Service Co, 1695 Twelve Mile Rd, Berkley, Mich*

***Progress** in plan-it-yourself air systems:*

You can use Schrader Air Products to produce faster at a lower cost

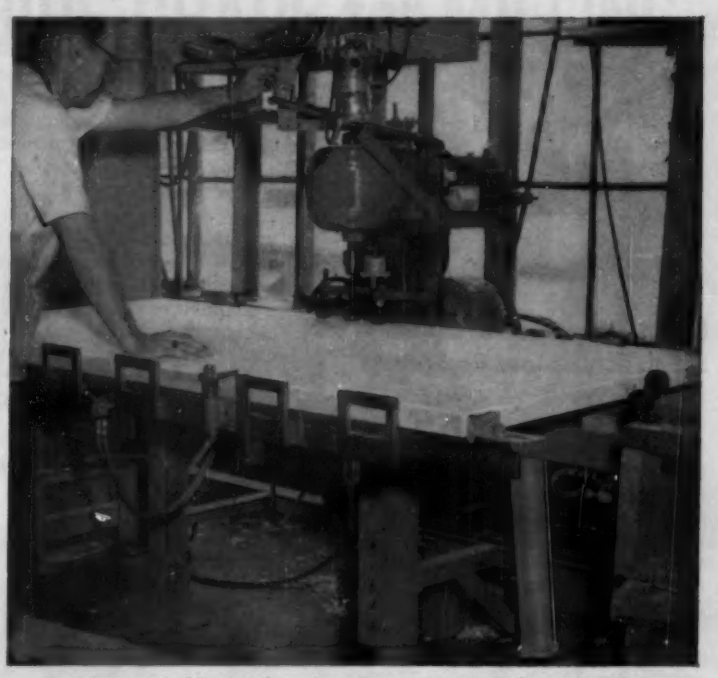
Air is a *natural* for many operations in processing, handling and other multi-step production . . . even to mortising doors in the woodworking field. Every day air's speed, simplicity and safety are effecting new production records.

Here's an example:

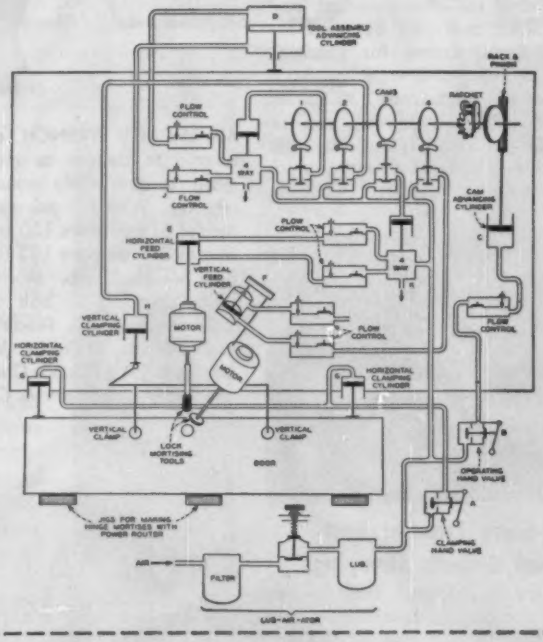
At a prominent Western woodworking company, Schrader Air Products are used on the door-mortising machine to clamp work in place, advance programming cam, and actuate all tool feeds. The machines work with extreme precision and the speed and economy of the operation are spectacular.

Chances are that Schrader Air Products can do the same for you no matter *what* you do. Take advantage of Schrader engineering facilities, available upon request, to assist you in planning for the best use of air in your production, and selection of the *right* Schrader Products to fit your needs.

Information is available by writing directly to us . . . and our Distributors are conveniently located for fast delivery.



A revolutionary building trend—pre-hung doors—means tremendous savings. Doors and frames are mortised for lock sets and hinges, assembled. This schematic shows how the door is prepared.



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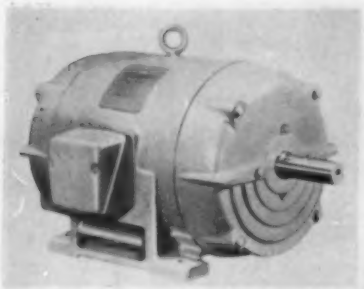
NEW SHOP EQUIPMENT, MATERIALS, AND PARTS



Motor is Designed for Constant-Speed, Varying-Load Applications

Motor called Syncro-Spede is reported to be industry's first synchronous induction motor built in the same NEMA frame size as a standard motor of equal horsepower. It accelerates as an induction motor but runs at exact synchronous speed without permanent magnets or dc excitation involving collector rings and brushes or wound rotating fields.

This motor is said to be the most compact ac motor available for synchronous applications and offers the highest power factor and efficiency. It is recommended wherever requirements call for constant and varying load, and can be used for constant speed drives for machine tools, or as a conveyor drive. It is available in ratings from 1 to 100 hp in any enclosure type and can be foot or flange mounted. Bulletin 1900.

Louis Allis Co, Dept P, 427 E Stewart St, Milwaukee 1, Wis

Lift-and-Carry Transfer Unit Feeds and Unloads Stampings

Lift-and-carry type combination transfer feeding and unloader unit can be used to load and unload one press or it can be placed in a line of presses with a continuous transfer bar to provide a completely automated transfer line.

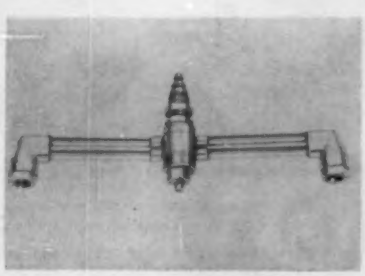
In operation, a stamping to be fed to press dies is placed in a preload station on the feeder. Fingers on the transfer bar pick up the part as bar is lifted and deposit it in an intermediate station as the part is carried forward and lowered by the lift-and-carry mechanism. The number of intermediate stations depends on the press spacing. On the next sequence of the transfer bar, stamping is lifted from the intermediate position, advanced and lowered into the die over gage pins.

When press has completed its cycle, unloading fingers on the transfer bar pick up finished stamping and advance it to next operation while another part is being loaded into die.

Unit occupies a floor space about 3 x 8 ft and is about 42 in. high. Length depends on press spacing in fully automated lines.

Press Automation Systems, Inc, 25418 Ryan Rd, Centerline, Mich

AIR IMPACT WRENCH, called Sioux, is said to deliver as much as 15% more torque while consuming 30% less air. With 90 psi air at wrench, Model 315 delivers 130 ft-lb in 10 sec; Model 317 delivers 185 ft-lb in 10 sec. Both weigh 5½ lb. Model 315 has a ½-in. drive, ⅝-in. bolt capacity and sells for $127.50; Model 317 has a ⅝-in. drive, 11/16-in. bolt capacity and sells for $138.50. Carrying case is available—*Albertson & Co, Inc, Sioux City, Iowa*

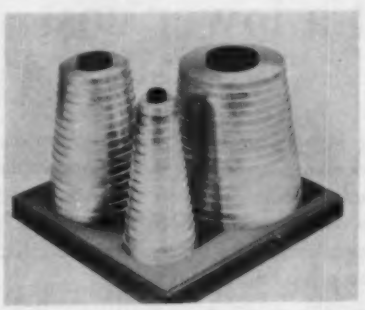


Airco Cutting Torch Attachment Speeds Plate Ripping

New accessory for use in making simultaneous parallel cuts with one Airco Style 4700 machine cutting torch is called the Duplex Tip Holder, and may be set to cut strips of any width from 1¼ to 12 in., in plate thicknesses up to 3 in. Minimum tip spacing is less than that of fixed holders now available. Device, which replaces company's entire line of fixed duplex holders, accepts acetylene, propane or natural-gas tips.

Although designed for machine cutting, this device can also be used in the Style 3000 and 9000 hand cutting torches for particular applications.

Air Reduction Sales Co, Div of Air Reduction Co, Inc, 150 E 42 St, New York 17, NY



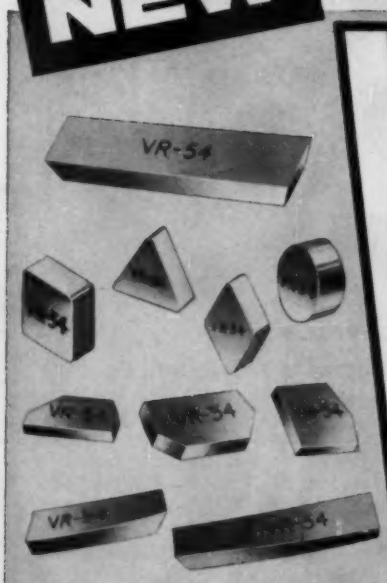
TRUING RING SET for use in boring soft chuck jaws to size consists of 48 rings. Complete set includes sizes from 1 to 4-in. OD in 1/16-in. increments. All rings are plated to prevent rusting—*Rockford Engineered Products Co, 2324 23rd Ave, Rockford, Ill*

Carbide Cutoff Blade Combines Chamfering and Parting

Solid-carbide circular cutoff blade for automatic screw machines provides a chamfering edge in addition to the cutoff edge. Work can be cut off in either direction of rotation because a portion of the blade is gashed to allow clearance. The brazed steel

NEW CARBIDE GRADE for MILLING

VR-54



Hardness: 92.0 Rockwell "A"

Transverse Rupture Strength: 325,000 psi.

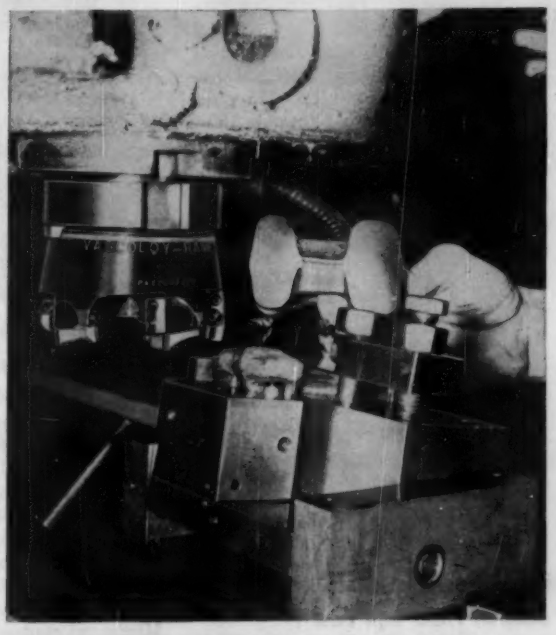
Density 14.50 g. per cc.

NEW VR-54 . . . Outstanding for interrupted cutting of cast iron, chilled cast iron, non-ferrous alloys and non-metallics

This new carbide grade incorporates toughness with high hardness to give the greatest possible resistance to abrasion and shock. These qualities enable VR-54 to outperform other cemented carbides in the removal of metal when milling, broaching, hobbing and rotary burring.

The exceptional uniformity and high quality of this new VR-54 is the result of Vascoloy-Ramet's new and unique process of manufacturing. Typical operations on which VR-54 has proved its superiority are: broaching motor blocks, milling cylinder heads, planing of planer beds, burring stainless steel rings for jet engines, milling ends of motor blocks, burring steel fabricated diesel motor blocks, and in rotary burrs for burring of all types of materials.

For complete information, call your local V-R representative or distributor or write.



MANUFACTURERS OF: CEMENTED CARBIDES, TOOLHOLDERS, TANTUNG® CAST ALLOY CUTTING TOOLS and THROW AWAY FACE MILLING CUTTERS.

Vascoloy-Ramet Corporation

SUBSIDIARY OF TAMTEEL METALLURGICAL CORPORATION

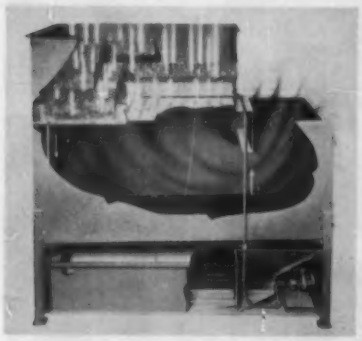
834 Market Street • Waukegan, Illinois C-649

hub, which holds the carbide blade firmly in place, assures long, trouble-free service.

Tool is available with OD's from 1¾ to 3 in. and normal thicknesses. Special sizes can be made to order. Literature available.

Gay-Lee Co, Clawson, Mich

MACHINE TOOL SWITCH can control as many as four separate circuits. Actuator is adjustable 360° on two planes. Two types are available; the double action model is used for controlling switch contacts when actuator is moved to either side of center or the "at rest" position. Electrical rating: 2 hp, 230-v ac; 1 hp, 115-v ac; 20 amp, 125-250-v ac; pilot duty 250-v ac—*Robertshaw-Fulton Controls Co, Acro Div, Columbus 16, Ohio*

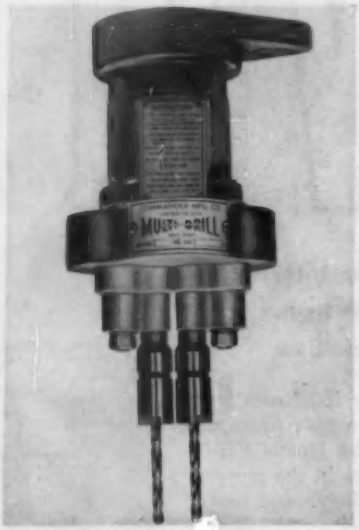


Redesigned Dust Collector Traps Dust in Fluid Bed Pad

The new Cycoil oil bath aftercleaner, Model P-17 is designed to collect dust particles that might escape conventional dry centrifugals or viscous impingement filters. Its high collection efficiency is said to make it ideal for such difficult metalworking dust problems as cast iron machining, production metallic grinding, and toolroom equipment grinding—operations which can cause oxidation damage.

This self-cleaning, automatic unit separates dust from the air as it passes through a viscous crimped-wire, fluid bed pan. The dust-laden air is mixed with the oil by means of a perforated plate over which the oil flows. Dirty oil flows to settling tank where dust particles settle out and then oil is recycled. High collection efficiency of collector permits recirculation of the cleaned air back into the workroom. Several sizes are available. Smallest unit has 2100-3000-cfm rating; largest single unit has rating of 7500-11,000 cfm. Units are just over 7 ft high.

American Air Filter Co, Inc, Louisville 8, Ky

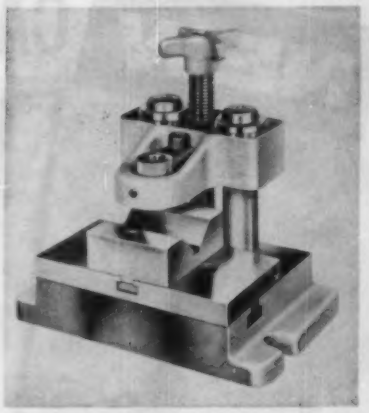


Commander Multi-Spindle Head Drills or Taps up to Four Holes

Model 400, mountable on any drillpress, is designed for applications where up to four holes are to be drilled or tapped at one time. Capacity is ¼ in. in steel; collet capacity on other materials is ⅜ in.

Adjustable spindles are driven by gear drive. Each spindle rotates from a fixed position and is adjustable to reach 3⅞-in. max bolt circle. Minimum center distances vary from ⅞ in. for the two-spindle unit to 1 in. for the three and four-spindle units. Price of the two spindle unit adapted to popular drillpresses is $175, complete with collet-type spindles.

Commander Manufacturing Co, 4825 W Kinzie St, Chicago, Ill



Adjustable V-Block Drill Jig Handles Work up to 2-in. OD

New adjustable V-block drill jig is designed to cut costs of precision center and off-center drilling, tapping and reaming. Standard equipment includes two interchangeable V-blocks, three interchangeable adapter bushings, and a centering locator plug. Device handles workpieces up to 2-in. OD. Bushings accept drills from 0.0135 to 0.5625-in. dia.

Interchangeable V-blocks are secured by two socket-head capscrews. Adapter bushings are changed by loosening a single lock screw and inserting a new size.

Rockford Engineered Products, Inc, 2324 23rd Ave, Rockford, Ill

INDUSTRIAL LAMP is optically designed for close work. The spot of light can be varied from ⅝-in. dia to 3-in. dia by sliding focusing tube back and forth in lamp housing. Unit can be adjusted to any position for convenient and best illumination. Lamp, with stand, bulb, and daylight filter, is priced at $27.50—*Edmund Scientific Co, Barrington, NJ*

cut it with

stop

1881 CAPEWELL

power hack saw blades

THE USER: Reisner Forge Company, South Gate, California
THE MATERIAL: Stainless Steel Billets
THE JOB: High speed production-line power hack sawing
THE PROBLEM: Blade breakage . . . too few cuts per blade
THE ANSWER: Capewell Safetech Power Hack Saw Blades
THE RESULT: Long blade life . . . blade breakage virtually eliminated.

The Reisner Forge Company chose Capewell's shatterproof Safetech Blade for this long, heavy job because they could get more cuts per blade quickly and economically under heavy feed, while providing complete operator safety. Other Capewell Power Hack Saw Blades are Technite and High Speed—each of these all-hard blades is designed to give proved maximum sawing performance.

You, too, can improve your production by standardizing on Capewell Power Hack Saw Blades. Tooth by tooth, you'll find that Capewell blades are a superior product, manufactured to rigid specifications, so that you can be assured of blades that stay sharper longer.

76 CAPEWELL ANNIVERSARY

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CAPEWELL DISTRIBUTORS
who provide: complete inventory
. . . engineering assistance
. . . delivery when you need it.

THE CAPEWELL MANUFACTURING COMPANY
Hartford 2, Connecticut

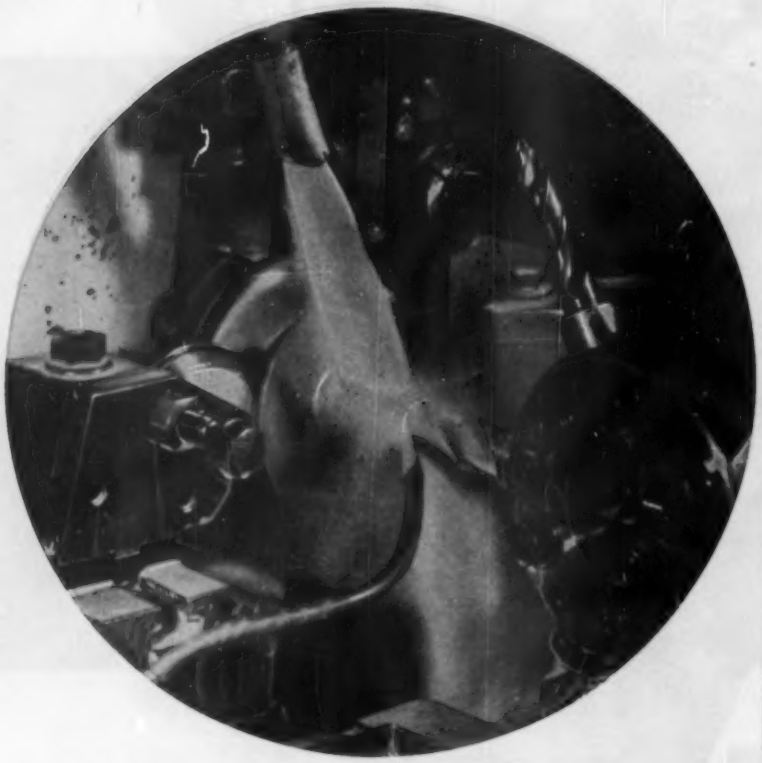
Please send complete details on Capewell Power Hack Saw Blades to:

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

LA

shamrock

top performer for automatic screw machines



Shamrock, a water-soluble chemical emulsion combining good cooling and extreme-pressure lubricating properties, is giving excellent service in single and multiple spindle automatic screw machines. It is also widely used when machining at moderate feeds and speeds for broaching, threading and tapping, as well as for drawing and stamping. It contains no sulfur or chlorine commonly used as extreme pressure additives, and it completely eliminates all smoke nuisance as well as the dermatitis problem. Shamrock helps keep any shop clean.

RESULTS THAT COUNT

Using Shamrock 5 to 1 a prominent Illinois manufacturer (name on request) increased tool life approximately 2½ times and entirely eliminated the smoke nuisance from the following operation: The work was drilling and tapping railway track and switch controls, the material 1020 and 1040 hot rolled steel, the speed 170 RPM, 50 RPM faster than possible with the previous coolant.

Send for descriptive literature.

The Lusol.. Line
BETTER PRODUCTS FOR BETTER METALWORKING

F. E. ANDERSON OIL COMPANY INC.
BOX 215, PORTLAND, CONNECTICUT
Branch Offices in Chicago, Detroit and Los Angeles
Distributors in other principal cities

NEW SHOP EQUIPMENT

Two New Heavy-Duty Machines Mark Flat or Recessed Surfaces

Large area imprinting of variable detail trademarks, designs, or other data can be done at rates from 30-60 per min by either unit.

Model 103A (illustrated), for flat object marking, has large diameter ink rolls and roll reservoir. Model 103AE, by means of its reciprocating printing head, will imprint recessed areas below top surface of the piece. Max imprint size for both machines is 9 in. front to back by 11 in. left to right. Variety of interchangeable workholding fixtures is available for handling numerous sizes and shapes.

Markem Machine Co, Keene 70, NH

Two-circuit limit switches recently introduced include a roller-plunger-actuated unit, 5 LSI, said to be especially effective for cam or slide operations, that can be rotated 90° from switch cover plate. Model 2LSI, a plunger-actuated switch, offers a full ¼ in. of overtravel. Contact arrangements of both are double-throw two circuit, single-pole double-break.

Micro Switch, Division of Minneapolis-Honeywell Regulator Co, Freeport, Ill

Degreasing compound, water emulsifiable Grease Ban, can be used either full strength or diluted with kerosene, and is washed off with water without leaving an oil film. In addition to degreasing metal parts, it is useful for cleaning concrete and glass and, because of disinfectant properties, as a general plant cleaner.

Parke-Hill Chemical Corp, Development Dept, 29 Bertel Ave, Mount Vernon, NY

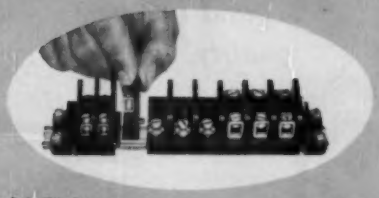
... delivery when you need it.

CITY _____ ZONE _____ STATE _____

50% MORE TERMINALS IN THE SAME SPACE!

SQUARE D's *NEW* TERMINAL BLOCKS

MORE FLEXIBILITY, TOO!



NOTICE *(above)* how little space is required to remove or add a Square D channel-mounted terminal block to the completely assembled unit. Especially important for a quick change when an additional terminal must be inserted into grouping.

LOOK *(at right)*... all sizes can be mounted on same channel...25 ampere pressure wire connectors, 25 to 50 ampere box lugs ...all can be interlocked together. Terminals in kit form to "do-it-yourself" or factory-assembled to standard specifications.

SEE *(below)*...there is only one perforated channel required for either weld or screw-on mounting...available in standard lengths that can be cut "on the job" to fit any length requirement. Eliminates stocking various sizes.

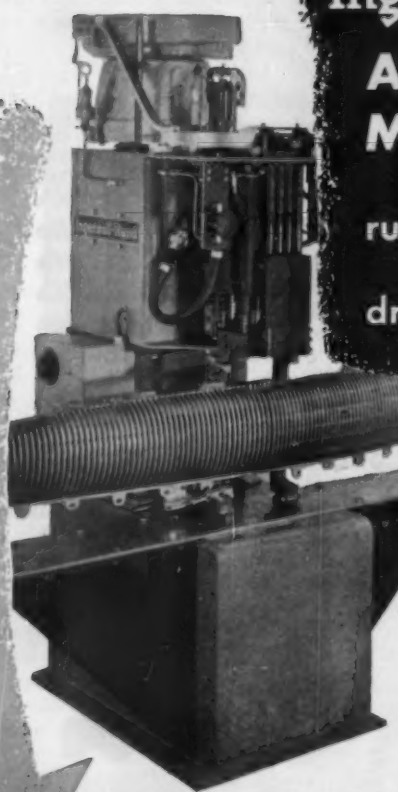
ASK YOUR SQUARE D FIELD ENGINEER
or write for Bulletin which covers details on Channel-Mounted Terminal Blocks. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY

put the f-a-s-t in fastening
... and improve quality, too...

with Ingersoll-Rand
ASSEMBLY MACHINES
for running nuts and driving screws!



● first in experience
● first in quality
● first in service

Any bolt size... any number of spindles... maintains desired torque manual or completely automatic operation. Write for an Ingersoll-Rand AIRengineer to survey your needs.

Automatic assembly machine feeds and drives four self tapping screws in three seconds.

8-522

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

NEW SHOP EQUIPMENT

Portable Marking Unit is Fully Equipped for Hand Stamping

Designated the Marking Cruiser, this portable unit contains everything necessary for hand stamping. It provides not only the tools, but also the working area. The unit includes a retractable tool, two hammers, absorber pad, adjustable lamp, and a working anvil. Rubber-tired casters are retractable for a firm stance when unit is in use.

The font case contains four 40-character sets of stamps in sizes 1/16, 3/32, ⅛ and 3/16 in. Over-all dimensions are 24 x 36 x 32 in. high. Price for complete unit is $650. Bulletin available.

Geo T Schmidt, Inc, 4100 Ravenswood Ave, Chicago 13, Ill

ASC micro-shim stock available in stainless, brass, and low-carbon steel is rolled on precision cluster mill equipment to tolerances as close as ± 0.0001 in. in thicknesses below 0.006 in., and to tolerances of ± 0.0002 in. in thicknesses from 0.006 to 0.010 in. It is furnished in thickness gradations down to 0.0005 in.

American Silver Co, Inc, 36-07 Prince St, Flushing 54, NY

Nesting pan, all-steel RAN/tote 802, is designed in size multiples to fit all standard shelving, can be used on roller, belt, or conveyor systems.

Randolph Industrial Equipment Co, 9550 W Grand Ave, Franklin Park, Ill

Winch, 35-lb Model 61 with self-contained motor and lifting capacity of 6000 lb, has reel-in rate of 10 fpm at capacity load. A 400-c ac motor is standard; where necessary, 28-v dc,

110-v ac-dc, or hydraulic drives can be used.

All American Engineering Co, Box 2668, DuPont Airport, Wilmington 5, Del

INDUSTRIAL LIGHTING FIXTURES, Series B, feature the Therma-Guard air-cooled reflector assembly which prevents accidental burns to operator. Model B-32 (illustrated) is equipped with 100-w reflector assembly and has a reach of 30 in. It is also available with clamp-type base. All swivels and bases are alloyed iron castings. This low-priced series of lights is described in company's catalog—*Woodward Machine Co, Lighting Div, 4833 Elmhurst, Detroit 4, Mich*

Precision spur gears, 24 and 32 pitch, are available in stainless, aluminum, nylon, and phenolic materials with variety of bore sizes from ⅛ to ¼-in. dia. Supplement catalog 13.

PIC Design Corp, Subsidiary of Benrus Watch Co, 477 Atlantic Ave, East Rockaway, NY

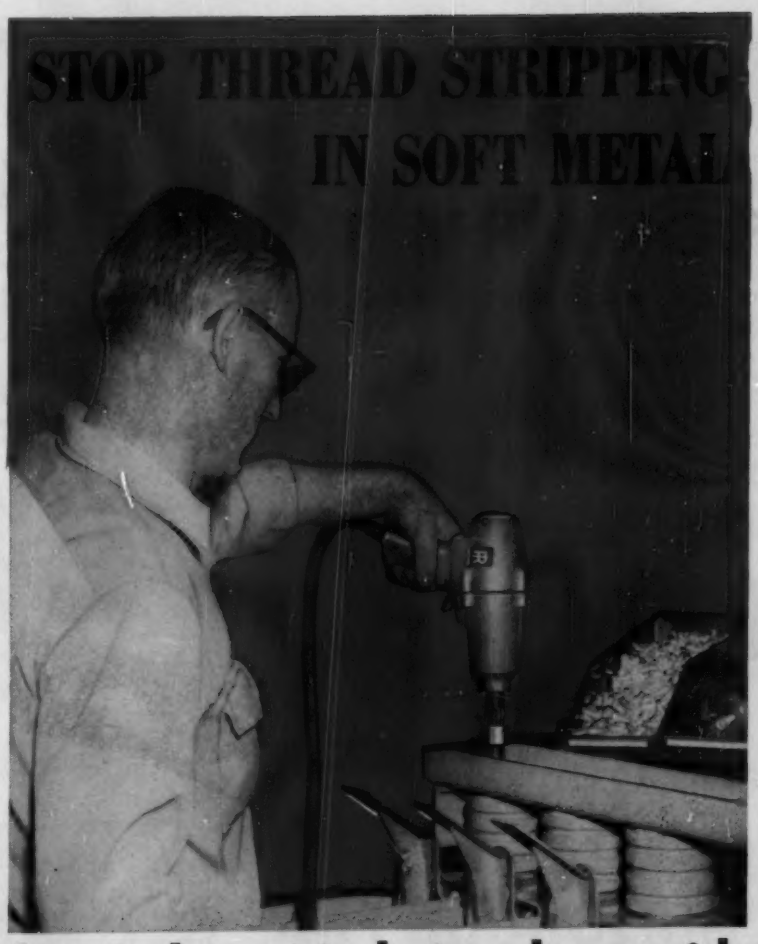
Steel cabinet line includes counter-height utility, and toolroom units featuring 3-point security latching, chrome door handles, and adjustable shelves; standard colors are gray and green.

Penco Metal Products Division, Alan Wood Steel Co, 200 Brower Ave, Oaks, Penna

Shaft-mounted, right-angle gear motors are available from ¼ through 5 hp. Aluminum construction makes them especially suitable for lighter pieces of machinery, or use in small areas.

Sterling Electric Motors, Inc, 5401 Telegraph Rd, Los Angeles 22, Calif

Uniclosed footless motor, designed for direct connection to driven equipment, is supplied with NEMA style C Unimount bracket for automatic alignment. Built to latest



here's how it's being done with Ingersoll-Rand TORQUE CONTROL impactools!

If you assemble soft metal threaded parts, such as aluminum or bronze, take a look at the improvement record made by this large electrical manufacturing company.

Parts spoilage is substantially reduced and product quality greatly improved since changing from conventional air powered wrenches to new Ingersoll-Rand Torque Control Impactools for running nuts and cap screws. These revolutionary Impactools shut off instantly and automatically when the preset torque is reached. No more stripped threads . . . and every fastener is precisely tightened for top quality.

Call or write for bulletin 5170, or ask for an obligation-free demonstration.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

9-523

BIG, 6-FOOT LAPOINTE ROTARY TABLE

of extreme accuracy . . . can take loads up to 50,000 pounds!

Indexing is semi-automatic or full-automatic, as desired, and guaranteed accurate within 5 seconds of arc. It will repeat consistently—"on the button"! Never before has a big production table been built offering such precision. Using master indexing gears, this Lapointe Rotary Table *cannot lose its accuracy*, regardless of the weight of the workpiece!

For programming, for tracing. Although originally developed by Lapointe as a broaching fixture, in smaller sizes, this Rotary Table can now be purchased separately and used for other machining purposes. Any external form can be milled or contoured to extreme accuracy. It will tilt to 90°. Can be made in any diameter from 24" to 84".

Write for illustrated Bulletin RP-2

THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS — U. S. A.
In England, Watford, Hertfordshire
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

LAPOINTE
known to be the best in
BROACHING

NEW SHOP EQUIPMENT

NEMA specifications, it is furnished in ratings from 1 to 30 hp. Bulletin F-1856.

US Electrical Motors Inc, Box 2058 Terminal Annex, Los Angeles 54, Calif

Carbide-tipped tube cleaning drill is available designed for efficient removal of both hard scale and soft coagulated deposits from inside walls of condenser tubes. Data on applications and standard sizes can be obtained from manufacturer.

Chicago-Latrobe, 411 W Ontario St, Chicago 10, Ill

Miniature precision couplings, Type T, are made of stainless steel with a nylon center block or an oil-less center block. Furnished in pin-type and clamp-type hubs in bore sizes of ⅛ to ¼-in. dia. Bulletin 13.

PIC Design Corp, Subsidiary of Benrus Watch Co, 477 Atlantic Ave, East Rockaway, NY

Blueprint rack, Glider 700 modular vertical file, accommodates 700 plans in sizes up to 24 x 36 in., stands 48 in. from the floor, and has outside dimensions of 24 x 24 in. Price of the all-steel unit with 24-in. plan holders (largest) is $54.50 fob Chicago.

Momar Industries, 4323 W 32nd St, Chicago 23, Ill

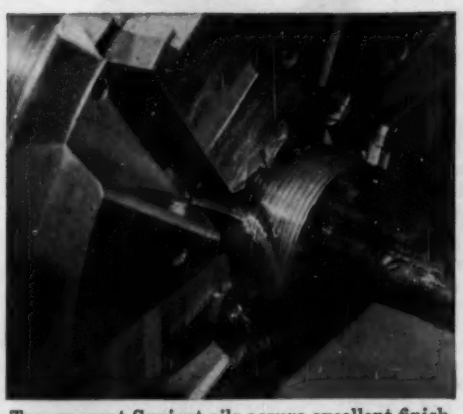
Guide wheel, designated Zefyr, for bandsaw guides, features lifetime lubrication sealed in with leak-proof metal and teflon seal. Honed raceway and matched ball bearings minimize wear. Wheel is being produced in two sizes: No. 20, corresponding to

"Oh nothing like that . . . his wife drove us to work."

JOE IS DETERMINED TO SEE EVERY STEP OF THAT PRECISION CUTTING JOB.
WE'D SAVE MONEY BY GETTING HIM SOME TRANSPARENT SUNICUT.
LOCKE

For precision cutting...

TRANSPARENT SUNICUT OILS ASSURE YOU GOOD VISIBILITY, PEAK PRODUCTION



Transparent Sunicut oils assure excellent finish in critical operations at close tolerances. Good visibility speeds production.

Transparent Sunicut® oils, including heavy-duty and dual-purpose oils, are available in many grades to suit your specific needs. They give outstanding results...especially where precision cutting is required.

Their transparency takes the "blinders" from work that needs close watching, permitting close product control, faster production, lower unit cost. Machine operators like Sunicut's "cleanliness." Most important, *transparent Sunicut oils assure you of good finishes.*

For full information about Sunicut cutting oils, call your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-12.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

Philadelphia 3, Pa.

In Canada: Sun Oil Company Limited, Toronto and Montreal

SUNOCO

®Sun Oil Company

NEW SHOP EQUIPMENT

trade size No 0 for 8000 to 10,000 fpm; and No 10, corresponding to trade size No 1 for 10,000 to 12,000 fpm which will handle over 100 lbs thrust load at 2500 hours average life.

Carter Products Co, Grand Rapids, Mich

Spectacle loop, called the 3 D 3 Opticaid, magnifies three times in three dimensions at arm's length. Unit has separate lenses for each eye; prescription lenses can be added when necessary.

Edroy Products Co, 480 Lexington Ave, New York, NY

Parts bin, one-piece design, fits wide range of standard and custom racks for use on assembly benches, as bin-end units, wall, and mobile floor units. It is available in 6-in.-long by 4-in.-wide by 3-in. high models, either single or partitioned, and in a size 6 in. long by 8 in. wide by 3 in. high.

Service Parts Systems, Inc, 13380 East Nine Mile Rd, PO Box 243, East Detroit, Mich

Pneumatic regulator (pressure reducer), the ¼-in. dome loaded RV-23, utilizes gas pressure for hand operation or three 18 to 30 vdc solenoids for remote control operation. Unit not only eliminates cranking characteristic of existing hand loaders, but offers wider inlet and outlet pressure ranges, and can be integrated into pneumatic systems requiring programming.

Marotta Valve Corp, PO Box 330-68, Boonton, NJ

"If it's the last thing I do I'll find out which one of you is the ventriloquist."

Toolmaker's ink is available in aerosol container, supplied in 6 and 12-oz sizes. Product reportedly will not flake or peel, adheres to all metals, glass, and plastic, resists heat when dry.

Crown Industrial Products Co, Dept AMN, 713 Amsterdam St, Woodstock, Ill

Tinning compound, AMCO No 2679, is available in powder form for tinning all metals prior to babbitting. It is said to form a strong, permanent chemical bond with cast iron, steel, and all metals used for bearings. Furnished in 1, 5, and 50-lb containers.

American Solder & Flux Co, 19th & Willard Sts, Philadelphia 40, Penna

North PVC-coated industrial gloves, said to be extremely abrasion and chemical resistant, and highly flexible, reportedly will not crack or peel, are non-flammable and non-oxidizing. Furnished in a wide variety of styles in full range of sizes.

Jomac Inc, 6128 N Woodstock St, Philadelphia 38, Penna

Power shift torque converter drive, offered as optional equipment, eliminates manual gear shifting on Allis-Chalmers lift trucks. Drive facilitates controlled inching of the unit to enable operator to stack loads faster and to maneuver truck into position with inching pedal.

Allis-Chalmers Manufacturing Co, Tractor Group, Milwaukee, Wis

Anti-repeat press control called Transmag, for use with Clark Type PV protector air valves, has no moving parts. Instead of relays, device utilizes magnetic amplifiers, diodes, a transistor, and a pulse transformer. Unit operates on 115-v ac power.

Clark Controller Co, 1150 E 162nd St, Cleveland, Ohio

Welding positioner tables with 165° manual table tilt (30° back tilt) are now standard on company's 100- and 250-lb-capacity positioners. Positioners are 33 in. long, 25½ in. wide and 23 in. high.

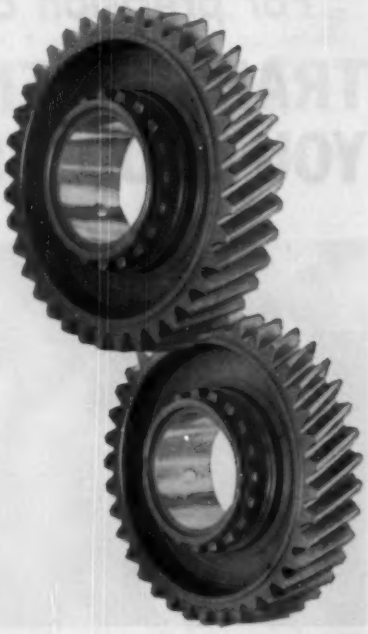
Pandjiris Weldment Co, 5151 Northrup Ave, St Louis 10, Mo

Liquid detergent called Acoustica Ultrasonic Cleaner No 715, for use on such hard-to-clean objects as lenses, precision parts, ball bearings, etc, is said to accelerate removal of

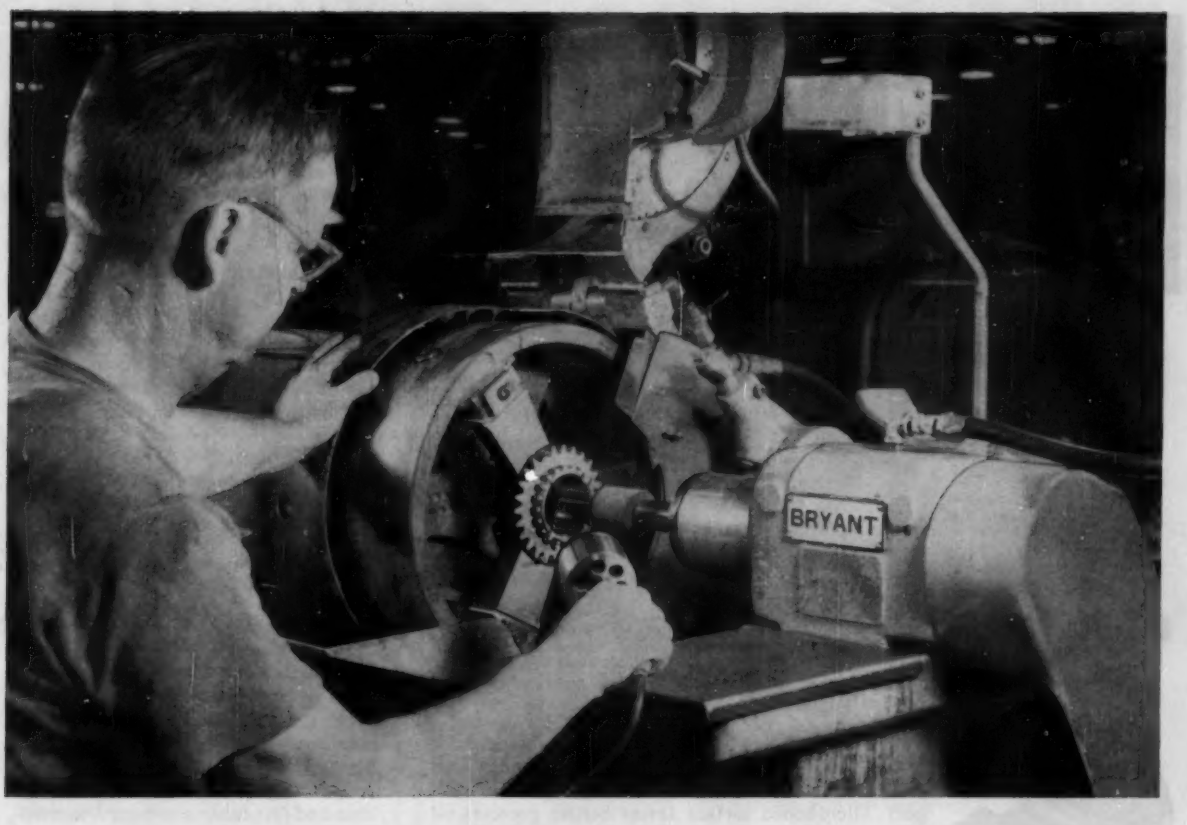
(Advertisement)

Meet BERNARD C. DAY

... one of Bryant's internal grinding experts, who helps solve grinding problems for customers throughout the Cleveland territory. Mr. Day can be reached at Center West Bldg., No. 307, 20950 Center Ridge Road, Cleveland 16, Ohio. Tel. Edison 1-9626.



Gears like these, ground on a Bryant 3216, are typical of the precision items made by Dana Corp.



Q. Why does Dana Corp., Toledo, Ohio, use eight Bryant 3216 Internal Grinders?

A. "The Bryant 3216 produces more parts for less money . . . gives better quality than manually operated machines . . . holds size consistently and finishes better."

The Toledo Division of Dana Corp., specializes in making a great variety of parts: transmissions, universal joints, propeller shafts, forgings, gear boxes and torque converters, to name only a few.

In the words of a company official, Dana is "a sort of glorified jobbing shop . . . our runs are comparatively short, and quick changeover ability is a key factor in our operation."

At Dana, the Bryant 3216 Automatic Internal Grinder has proven superior to other makes. The company first bought four 3216's, and then, because of their excellent performance, bought four more.

Here are some of the things Dana likes about Bryant 3216's: —

"they're economical . . . we're able to have one man run two machines, and cost is cut to about 60% of single-machine operation."

"the 3216 holds size consistently and finishes better."

"holds tolerance very well . . . you can depend on it to do the job it is supposed to do."

"there is almost no maintenance . . . these machines have run trouble-free since we've had them."

"simple to operate . . . easy to adjust . . . hold close tolerances . . . meet all our requirements."

Learn how the Bryant 3216 Automatic or other Bryant machines can help *you* in your internal grinding operations. Write today for literature.

BRYANT Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT

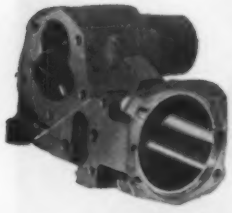
Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

Why MICROHONING

Is Final Stock Removal Process For Interrupted and Blind-End Bores

To secure low-cost, final stock removal, that generates accuracy and functional surface characteristics in a variety of bore conditions, a leading manufacturer of power steering assemblies uses Microhoning. Here are details concerning types of bores and stock removal results obtained by using Micromatic "Know How"—



STEERING GEAR HOUSING—Microhoning consistently corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—cuts boring tool sharpenings—lowers down-time and tool costs.

Material: Soft Malleable Iron
Bore: 3.125"D x 6.93"L (Ported bore with ¼" relief at blind end)
Stock Removal: .002"
Finish: 50 Microinches RMS
Microhoning Cycle: 18 sec.
Preceding Operation: Boring

PISTON RACK—Microhoning answers the need for a final stock removal process that generates a controlled surface finish in the bore of this leaded steel part. Microhoned surface (cross hatch) prevents oil leakage and holds to a minimum the wear of seal that operates in the bore.

Material: Leaded Steel (Rockwell 62 "C")
Bore: .875"D x 3"L
Stock Removal: .005"
Finish: 20 Microinches RMS
Microhoning Cycle: 20 sec.
Preceding Operation: Boring and H.T.

VALVE HOUSING—Microhoning consistently holds size and geometric accuracy—meets stringent surface requirements—assures alignment of four lands in bore. Thus, there is no leakage of oil around control valve which is selectively fitted to its housing.

Material: Cast Iron
Bore: .770"D x 2.18"L (Interrupted)
Stock Removal: .0025"
Tolerances: Size .0005"
Roundness .0001"
Straightness .0001"
Finish: 10 Microinches RMS
Microhoning Cycle: 12 sec.
Preceding Operation: Boring

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____ G
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

soils in far less time than present solutions. Water-based product is suitable for use with all types of ultrasonic cleaning systems.

Acoustica Associates, Inc, Dept 715, 26 Windsor Ave, Mineola, NY

Lift truck attachment for gasoline powered units in capacities of 15,000 to 20,000 lb is a swing-shift, side-shift hydraulic device controlled by separate handles. It can shift the truck forks and load 6 in. to either side of center, permits slewing forks and load in a 10° arc in either direction away from normal straighforward position.

Yale & Towne Manufacturing Co, Materials Handling Div, 11,000 Roosevelt Blvd, Philadelphia 15, Penna

Job rods for use with company's Layout Drilling Machine greatly extend the range of the machine and simplify locating, drilling and boring. Each rod is bored with ¼-in. holes at locations corresponding to hole spacing on workpiece. Each hole in workpiece is located by placing a stop pin in each rod. As a hole is finished, pin is moved to next hole and the table positioned to next location.

Cleereman Machine Tool Corp, 555 W Washington Blvd, Chicago 6, Ill

No. 42 Deadener has been developed for use on steel surfaces as a sound and vibration deadener and anti-corrosive coating. Non-flammable, non-toxic, non-explosive, and odorless, product can be used any place where there is a problem of metal-produced noise.

Philip Carey Mfg Co, Lockland, Cincinnati 15, Ohio

Flame-hardened bed ways are now available on Delta 11-in. metalworking lathes in both the 4-ft and 5-ft-bed models. The new bed ways—available at an extra cost of $75 on the 4-ft and $100 on the 5-ft-bed models—are flame hardened, then precision ground with a diamond-dressed wheel on precision way-grinding equipment.

Rockwell Mfg Co, Delta Power Tool Div, 414 N Lexington Ave, Pittsburgh 8, Penna

Gage block maintenance kit consists of a black granite-diorite deburring stone, camel's hair brush, insulated forceps, package of industrial lint-free wiping tissues, two booklets on gage blocks, and two aerosol-type

sprays for cleaning and preserving the blocks. This kit is now supplied with each gage block set of 38 pieces or larger.

DoAll Co, Des Plaines, Ill

Power steering is now available as optional equipment for company's series of pneumatic-tired trucks in the 3000, 4000 and 5000-lb capacity range. A flow divider in the hydraulic system always directs fluid first to the power steering unit, thus assuring fast, immediate and dependable steering action.

Hyster Co, 2902 N E Clackamas St, Portland 8, Ore

New line of 16 stock spline bore bushings added to Browning products provides means of application of sheaves, hubs, sprockets, couplings, and other power transmission items to spline bore shafts. Bulletin HB-101-A.

Browning Manufacturing Co, Maysville, Ky

Thermoshell electric heating elements for pipe, tube, and tank heating can be furnished in variety of shapes and sizes. They are available to heat to a temp of 2000 F, as well as at all lower temps from room on up. Bulletin provides details.

Cooley Electric Manufacturing Corp, 50 E Shelby St, Indianapolis 7, Ind

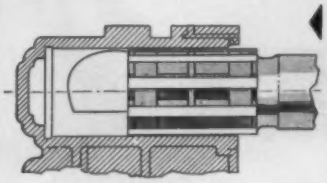
Combination drill and reamer, called the Dreamer, is a HSS tool designed to reduce production costs by eliminating the necessity of two setups and double handling in drilling and reaming operations. It is available in sizes from ⅛ to ⅝ in. in increments of 1/64 in. Also available is a model

"This outfit pays pays twice what our company pays. Employment just around the corner."

How MICROHONING

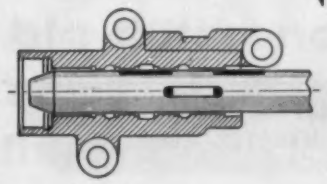
Cuts Costs—Generates Accuracy—Speeds Production of Interrupted, Blind-End Bores

Shown are two Microhoning machines that are used in the plant of a leading manufacturer of automotive power steering assemblies. Machines are equipped with automatic stone feed and stonewear compensating mechanisms, and automatic sizing controls. A two-position rotary fixture is interlocked with machine controls for fully automatic index cycle. The following applications tell more of the "how".



STEERING GEAR HOUSING—In Microhoning the ported, blind-end bore of steering gear housing a nine-stone tool is used. At least six of nine stones are in contact with bore surface when tool passes over irregularly shaped port. Removing .002" of stock from 3.125"D x 6.93"L bore in 18 seconds, Microhoning generates final accuracies and a controlled finish of 50 microinches as specified.

PISTON RACK—In 20 seconds, Microhoning removes .005" of stock from .875"D x 3"L open end leaded steel bore of piston rack. Self-sharpening abrasives assure a consistent generation of specified surface finish of 20 microinches.



VALVE HOUSING—Microhoning tool used for final stock removal in bore of valve housing has one bank of stones and two banks of plastic guides—three stones or guides in each bank. Guides act as tool pilots and stabilizers in interrupted bore—prevent overcutting at edges of lands—assure straight bore by keeping tool aligned. Self-dressing abrasives consistently generate geometric accuracy of .0001" and surface finish of 10 microinches.

Microhoning economically removes stock—corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—lowers machine tool downtime and maintenance to cut costs and speed production.

Send Coupon for Complete Information

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____ G

TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE_____ STATE_____

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Atrax PROGRESS REPORT

SOLID CARBIDE TOOLS

CASE HISTORY #17
WESTERN ELECTRIC CONTROL MANUFACTURER

Atrax SPECIAL DRILL .125" diameter

OPERATION	Removing fin burs left by compacting die.
MATERIAL	Plastic resistors
SPEED - FEED	16,000 r.p.m.
PRODUCTION	3 weeks per Solid Carbide tool. Only one day for H.S.S. drill.

CASE HISTORY #22
MIDWEST AIRCRAFT MANUFACTURER

Atrax ROUTERS Series 1540

OPERATION	Routing an assembly.
MATERIAL	Fiberglas & hard aluminum
SPEED - FEED	20,000 r.p.m., hand feed
PRODUCTION	Solid Carbide production 100 times that of H.S.S. tools.

CASE HISTORY #35
LARGE MACHINE TOOL MANUFACTURER

Atrax A-23 BUR Fine Diamond Cut

OPERATION	Interrupted I.D. Grinding Stock removal .006"
MATERIAL	H.S.S. Rockwell C62-64
SPEED - FEED	31,000 r.p.m.
PRODUCTION	Solid Carbide Bur produced 500 piece parts per sharpening.

Atrax

Send today for the "STANDARD REFERENCE" on Carbide Tooling—96 pages of tools and information.

THE ATRAX COMPANY
Newington 11, Connecticut

made of cobalt alloys for use on stainless steel. Special sizes on request.

Custanite Corp, 1228 Utica Ave, Brooklyn, NY

Air-acetylene torch contained in Handi-Heet soldering torch kit can be used for soldering, light brazing, leading, thawing, and similar jobs. Complete units with preset regulator are available to fit commercial tanks and styles B, POL, and MC tanks.

Smith Welding Equipment Corp, 2633 Fourth St, SE, Minneapolis 14, Minn

Magnesium scribers for use in tooling, styling, model, and pattern shops, weigh 12 oz per ft, and are available in six standard sizes up to 48 in. in length. Tip provided is hardened and ground tool steel. Details in brochure 824.

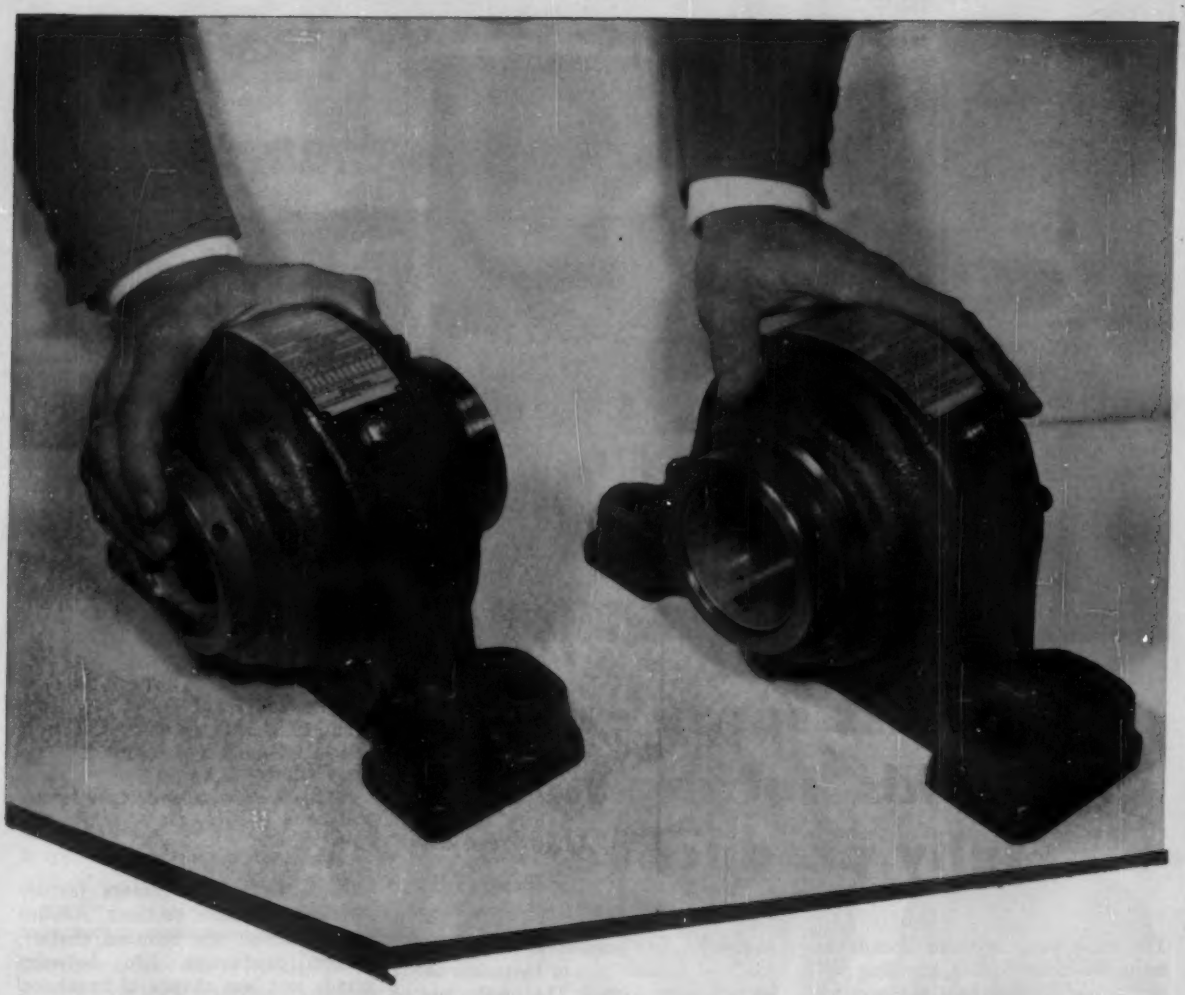
Challenge Machinery Co, Grand Haven, Mich.

Lead hammer molds, tubular steel lead hammer handles and lead hammer alloy are now available for those who prefer to mold their own soft hammers. Three sizes are available —for 1½, 3 and 5-lb hammers. Brochure on request.

Podlin Tool Co, 11911 Franklin Ave, Franklin Park, Ill

Rotary tables of 9 and 12-in. dia have been added to company's line (*AM* —Mar 11 '57, p186). Tables can be used horizontally as well as vertically. All models are available with chucks and chuck adapters and with a new tailstock accessory that allows tables to be used more effec-

"It's my alarm clock, sir—it went off while I was asleep."



There's a big difference in these pillow blocks . . . Bearings, Inc. knows the difference. Do you?

One of these pillow blocks contains a non-expansion or "fixed" bearing unit. The other is an expansion or "floating" bearing. Mix them up—order a "fixed" bearing where conditions dictate an expansion unit—and you are in trouble. Bearing failure in a very short time is almost certain.

One of our customers recently ordered spare bearings for new coal handling equipment and overlooked that important difference. They allowed us to check their survey of bearing requirements against the actual bearings installed on the equipment. We found on many applications "floating" units were required and their order failed to specify this vital point. Savings in time, trouble and money for our customer by this simple check were important.

Let us help *you* survey your bearing requirements—let us check the actual bearings in your equipment and we will be ready with the correct bearings you need when you need them. Call or write our branch nearest you now!

Providing bearing service in the north

BEARINGS, INC.

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden
NEW YORK: Buffalo, Bolanrol Corp. • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

and in the south

DIXIE BEARINGS *INCORPORATED*

FLORIDA: Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge • New Orleans
N. CAROLINA: Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville

tively in the vertical position to hold work between centers. Catalog available.

Universal Vise & Tool Co, Parma, Mich

Adjustable speed drives, designated Speed Variators, are available in ratings of 3 through 150 hp and in speed ranges of 8 to 1 and higher. New Amplistat regulator with silicon rectifiers is standard on new line.

General Electric Co, Direct Current Motor and Generator Dept, Schenectady 5, NY

Electrode, Airco 90C, for use with small-transformer power sources in the all-position welding of light-gage mild steel provides good penetration at rapid travel speeds. Easy starting tip arcs immediately under low open-circuit voltage. Physical properties of the deposit include tensile strength of 76,400 psi; yield strength, 66,500 psi; elongation in 2 in., 24.5%; and reduction of area, 51%.

Air Reduction Sales Co, Div of Air Reduction Co, Inc, 150 E 42 St, New York 17, NY

Carbide chucking reamers feature solid-carbide flute sections. Advantages claimed are reduced chatter, longer productive life between grinds and less chance of breakage. These straight shank tools are available in decimal sizes 0.230 to 0.760 in. and fractional sizes ¼ to ¾ in. Catalog available.

Super Tool Co, Div of Van Norman Industries, Inc, 21650 Hoover Rd, Detroit 13, Mich

Iron powder electrode, Speedex Triplex, is designed for downhand welding with either drag or open arc technique, and will deposit 16 lb or more of weld metal per hr. It is available in ¼-in. dia only, for use on large fabrication jobs. Welds produced have ultimate strengths of 60,000 to 65,000 psi.

Metal & Thermit Corp, Rahway, NJ

Aluminum hollow bar stock is now available in alloy 2011-T3. Designed for extremely high speed operations, this alloy offers excellent machined finishes at a low rate of tool wear. It is recommended for threading, tapping and screw machine work where free-cutting aluminum is desired.

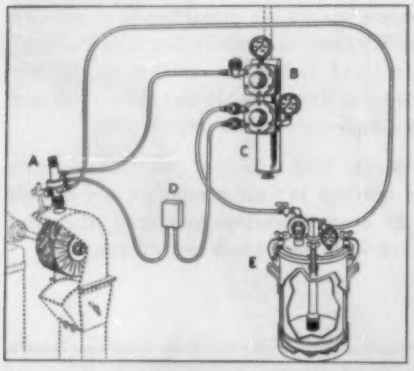
Harvey Aluminum, 19200 S Western Ave, Torrance, Calif

DeVilbiss spray guns make his buffing time fully productive

The time your operator spends in manually compounding, handling polishing and buffing bars is saved for productive work when compounds are spray-applied. And the DeVilbiss spray method offers the most efficient way to keep wheels properly conditioned for faster, consistently high-quality work!

Compounds are uniformly applied—in just the right amount—at the simple touch of a valve . . . or by means of an automatic control. The result: important savings in time and material. Waste through nubbins, and broken pieces is completely eliminated!

Call our nearest supplier for profit-saving information about DeVilbiss spray systems for polishing and buffing applications.



Complete DeVilbiss low-pressure "unit" system adapts to large or small manual or automatic installations. System includes (A) spray gun, (B) air transformer, (C) air regulator, (D) 3-way control valve, (E) pressure-feed tank, and hose.

THE DEVILBISS COMPANY
Toledo 1, Ohio
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FOR BETTER SERVICE, BUY
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DEVILBISS HELPS YOU GET THE MOST FROM THE SPRAY METHOD

WHATEVER THE APPLICATION

you can improve your product with

GRAMIX®

(PRODUCT OF POWDER METALLURGY)

PRECISION FINISHED PARTS

GRAMIX precision finished parts are improving products in virtually every branch of industry. A pump manufacturer, for instance, may specify a gasoline pump rotor made of GRAMIX and gain a number of advantages.

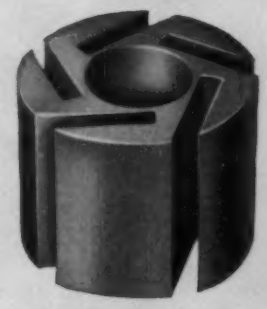
To begin with, the alloys are carefully blended to meet his individual requirements. The GRAMIX parts are then die-pressed to exact shape, sintered under rigid control and finished to tolerances as close as .0005". (This process, of course, costs far less than machining, forging or casting.) The manufacturer can expect the GRAMIX gasoline pump rotor to do a better job because *all* GRAMIX parts are precision engineered and precision controlled from alloying to finishing.

No matter what the application may be, GRAMIX parts fit specifications exactly. Parts may be impregnated with oil . . . to insure a longer life and a quieter operation: if specified, the GRAMIX parts may be coined and work hardened, even prepared for plating.

The rotor is only one of thousands of applications in which GRAMIX precision parts have proved to be ideal. Just a few of them are shown here, so consider the components of your products . . . there may be several that could be improved . . . with GRAMIX! Products of powder metallurgy you can rely on.

Hardened steel drive sprocket for lawnmower

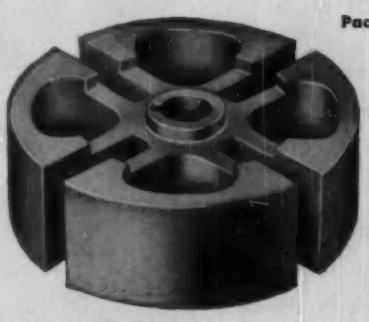
Iron switch control



Rotor for gasoline pump

Packing gland follower used in hydraulic system

Write today for factual Engineering Bulletin No. 21 . . . we'll send your copy.



Bronze rotor in high speed fueling unit

X-245-1

THE UNITED STATES GRAPHITE COMPANY

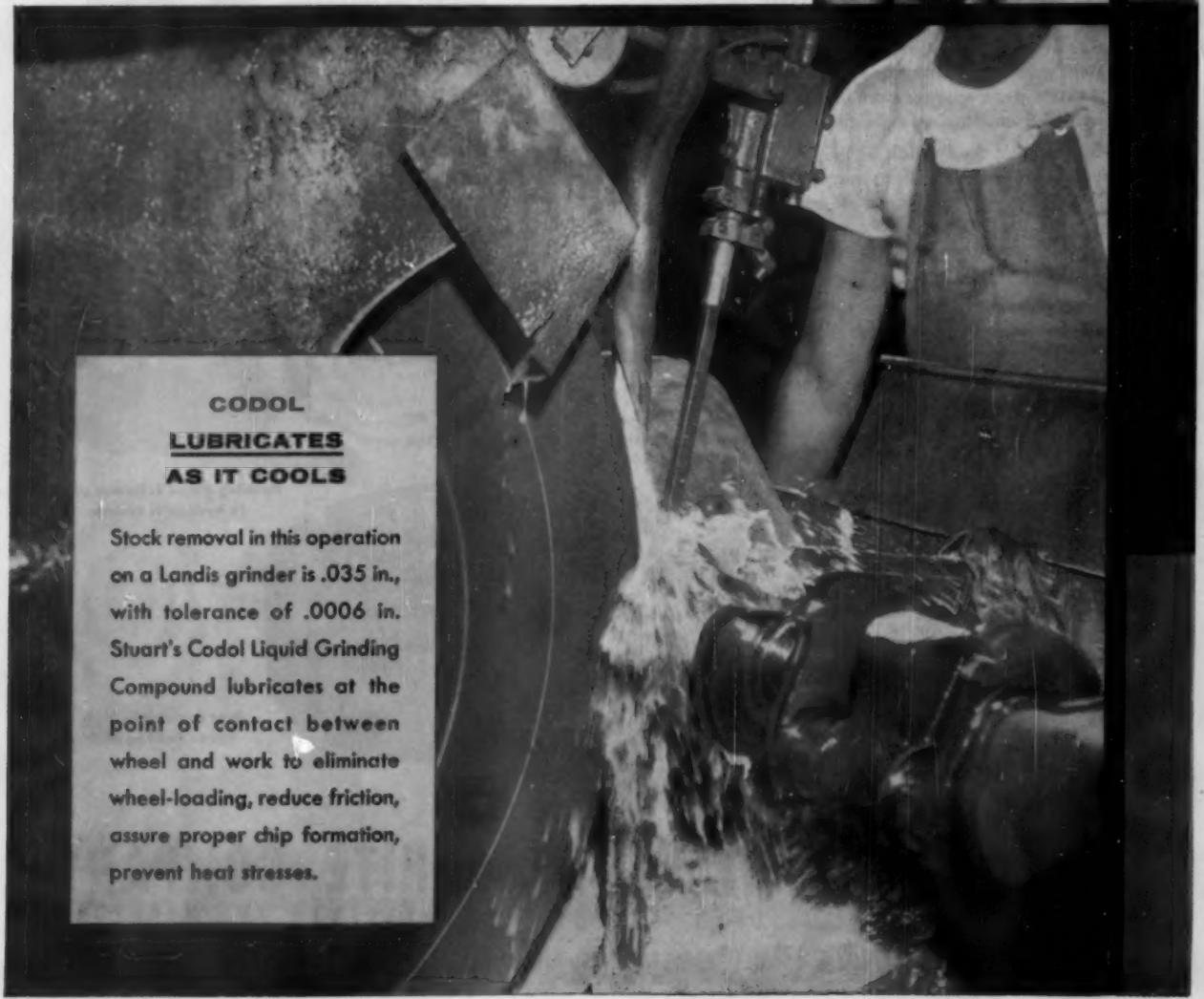
DIVISION OF THE WICKES CORPORATION, SAGINAW 23, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDERED METAL PARTS • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

Now grinding wheels run clean, give finer, more accurate finish at "big-three" truck plant

Stuart

CODOL
LIQUID GRINDING COMPOUND



CODOL
LUBRICATES AS IT COOLS

Stock removal in this operation on a Landis grinder is .035 in., with tolerance of .0006 in. Stuart's Codol Liquid Grinding Compound lubricates at the point of contact between wheel and work to eliminate wheel-loading, reduce friction, assure proper chip formation, prevent heat stresses.

Now that about 30 grinding machines in the crankshaft and other departments of this truck manufacturing plant are using Stuart's Codol Liquid Grinding Compound, all hands agree that results are much better, problems greatly reduced. Wheel-loading and burning, which were problems with a coolant previously used, are now eliminated and a distinct improvement in finish is noticeable. Codol efficiently cleans both wheel and work, drops all chips in the tank, and returns clean. Rusting, also once a problem, is now absent. Effective cleansing and superior lubricity characteristics keep temperatures down, eliminate burning, and improve accuracy.

On-the-job economies with Codol add up to a substantial saving on costs experienced before. The previous compound had to be mixed one part coolant to 30 parts water. Excellent results are now achieved mixing one part Codol in 60 or 70 parts water. Clean-running wheels last longer, produce more parts. The previous coolant often went sour in a few days—Codol stays fresh for the full period between scheduled chip clean-outs.

HERE'S WHAT THEY SAY ABOUT STUART'S CODOL:

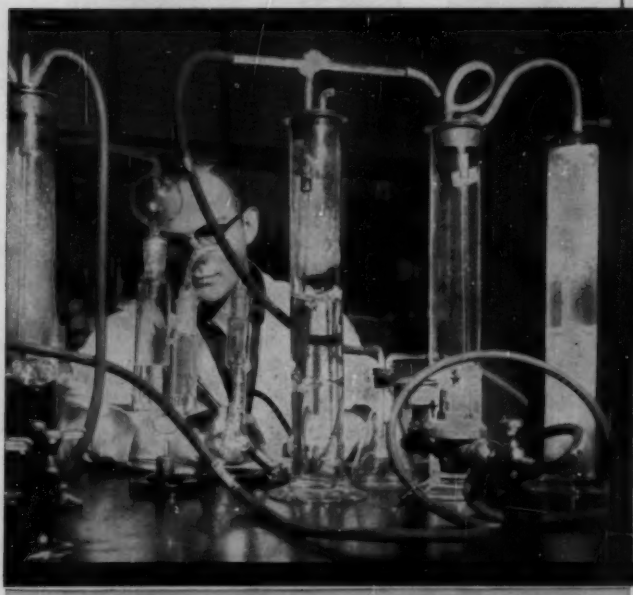
"The wheel doesn't load up as it did before . . . finish is much improved . . . work runs cool, and this gives us improved accuracy . . . gives us more cuts per wheel."—grinding machine operator

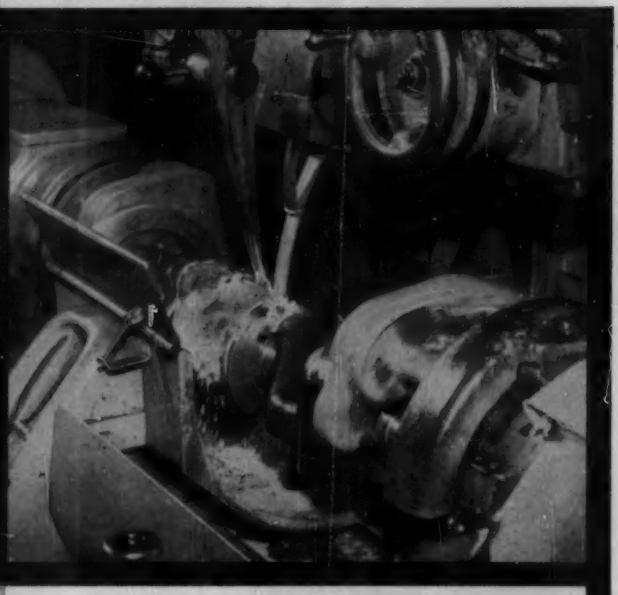
"Wheel-loading and burning used to be serious problems. Now, we get better corners and no burning of the side wall. Codol permits us to run without pumping until the tank is almost full of sludge."—foreman

"Now we have no rusting whatever. Another point—we leave our Codol standing over the week end and have no worries about its deteriorating and going rancid"—grinding machine operator

The plant's engineering laboratories tested numerous coolant materials and reported Codol to be unsurpassed as a remedy for the wheel-loading problem.

Codol eliminates tearing and scratching of the finish and has earned full credit for a marked increase in wheel life on thirty grinders throughout the plant.





Phone your
Stuart Service Center

Arrange now to test Stuart's Codol Liquid Grinding Compound on your difficult grinding operations.

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CHICAGO, ILL. . . . . Bishop 7-7100
CLEVELAND, OHIO . . . . . Prospect 1-7411
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METALWORKING LUBRICANTS

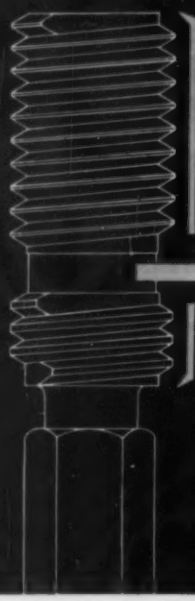
Do You Waste Thread Ring Gage Life? Are You Using Full Ring Tolerance?

Pipe Machinery Hilo Set Plugs are The One Sure Way to Tell

Can you be sure your thread ring gages and other adjustable instruments for inspection of male threaded parts are not being scrapped before you have used the tolerance to which you are entitled? If you're employing conventional setting plug gages that depend on the human yardstick . . . the individual operator's sense of feel and snug fit . . . you can't. Chances are you're wasting ring life!

Pipe Machinery's new more accurate Hilo Set Plugs are designed with two sections having different pitch diameters but identical lead and angles. The front end is made to the extreme low limit of prescribed ring gage pitch diameter tolerance—the back end to the high limit. There's no guesswork in sizing and setting. If the smaller end of the plug enters and the larger end is held out, the ring is the proper size for the tolerance specified. You use all the life built into your adjustable thread gages . . . reject them instantly and positively when the ring is out of limits.

Write for additional information.



THE
PIPE MACHINERY COMPANY
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

Round Table...

MANAGER OR SUPER MECHANIC

Does a foreman have to know everything about the equipment in his department—to the extent of being able to repair breakdowns—or should he concentrate on being a skilled administrator?

A REALLY competent foreman should know all there is to know about actual on-the-job skills in his department. Many foremen, far too many, scrape through without much knowledge of actual on-the-job skills. From time to time I've had excellent opportunities to observe how they do it. There are several methods; high on the list is the bulldozer way. Those who are not quite sure of themselves, because they don't measure up in the matter of shop skills, ride rough-shod over everyone but their boss.

Their objectionable aggression is mostly a smoke screen to hide from others their shortcomings concerning practical skills. Ostentatiously, they pooh-pooh the importance of skill in a foreman, while in their heart of hearts they feel like kicking themselves for lack of it. Then there's the rollicking back-slapper, hail-fellow-well-met, who is all things to all men. He has no idea of the dignity of foremanship, so steeped is he in the indignity of leaning instead of leading. The list is a long one. The shop foreman must be master of his job, the skills of his job, if he is to command the respect of his men. No other quality will give him that respect in such full measure.

The ambitious foreman who knows the skills of his job from A to Z

"Things are a little slow today."

American MonoRail Company Saves Tools, Time and Money

with McCaskey Tool Control System

Russell N. Giersch, Plant Engineer of the American MonoRail Co., Cleveland, writes:

"During the first year of operation, McCaskey Tool Control *reduced tool inventory 10%, reduced tool purchases 10%.*

"We practically *eliminated lost time of men and machines* caused by searching for missing tools. And we recovered many idle tools as well.

"In the first year of use, the McCaskey Tool Crib Control System *saved us several times over* the cost of the entire installation."

The McCaskey System can save time, money and tools at your plant too — without adding crib personnel. McCaskey Systems are simple to use, completely flexible. Can be set up in any plant, regardless of size or product. Find out how *you* can cut needless tool expense. Mail the coupon today.

McCASKEY INDUSTRIAL CONTROLS

Production • Inventory • Tools • Maintenance • Costs

Division of

VICTOR ADDING MACHINE CO.

3900 N. ROCKWELL STREET, CHICAGO 18, ILLINOIS

VICTOR-McCASKEY LIMITED,
GALT, ONTARIO, CANADA

Manufacturers of Business Machines
Cash Registers, Business and Industrial Systems
Electronic Equipment, Electri-Cars.

FREE BOOKLET!

Victor Adding Machine Co.
McCASKEY INDUSTRIAL DIV., Dept. AM1257
3900 North Rockwell Street, Chicago 18, Ill.

Please send me your booklet, "How Tool Costs Were Cut 12 Ways in 20 Plants."

Name .....

Position .....

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Here are the

STUPALOX

oxide cutting tools

which have produced such sensational results!

Production increased...

costs greatly reduced...

and performance is better

ACTUAL CASE HISTORIES were made on the use of Stupalox oxide cutting tools in a variety of applications. Wherever aluminum oxide cutting tools are properly used, production goes up from 2 to 10 times and machining costs go down from 30% to as much as 75%. Consequently, capital investment in machines and floor space can be reduced.

FASTER SPEEDS, SMOOTHER FINISH, and longer tool life are bonus benefits. That's because Stupalox cutting tools have exceptional wear-resisting properties. They retain their strength at 2000°F and higher. They're resistant to the strongest acids and chemicals normally encountered in machining operations, and nonmagnetic. For complete details, write for Catalog 257.

STUPAKOFF DIVISION OF

The CARBORUNDUM Company

LATROBE, PENNSYLVANIA

cannot but be a leader. Such a foreman will lead naturally, without conscious effort. He would not, could not stand aside and see an operator work unskillfully without putting him to rights. That's leading, and that takes a trick with the men, it gives the foreman standing. Make no mistake about this; when the men sense that the shop foreman is master of his job as a craftsman, discipline is easily kept, production times are low, standard of workmanship is high, and the shop atmosphere is agreeable.

There are always the exceptions, of course—the excellent craftsmen with no desire for executive control. They have the requisite qualities but not the desire to lead. They lack push and go and are quite unhappy away from the bench or machine. A desire for leadership and a flair for leading, allied to a wide knowledge of actual on-the-job skills, those are the qualities that make good foremen, foremen who please the men and impress the bosses.

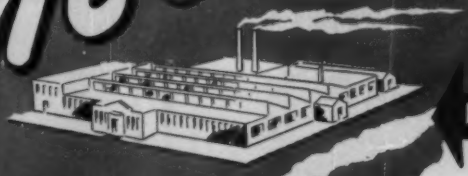
Every good mechanic won't necessarily make a success of running a mechanical department. Something more than being a good mechanic is required, although having a really wide knowledge of the skills involved in the manufacture of the work in progress is a powerful weapon in the hands of an ambitious and determined man. I would put that quality first in the affections of the men. They always fall for the foreman who knows the job, who has been through the mill and who can guide, advise, and confidently instruct. They will overlook much in a foreman who knows the job and all the answers, but a good mechanic must have other qualities to recommend him before he can be pronounced capable of successfully handling a mechanical department

A good mechanic who sets a good

"Oh, I like the present administration. It's just that I get the feeling they don't like me!"

Announcing

SUPERIOR's NEW MANUFACTURING PLANT IN Connecticut



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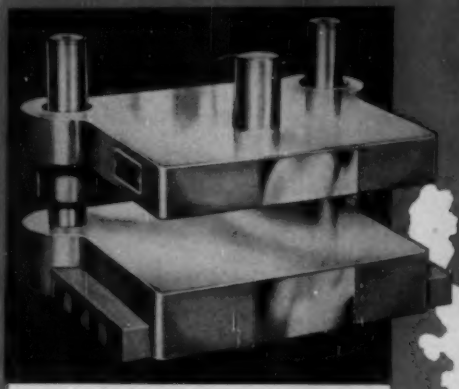


now manufacturing for the Eastern Tool & Die Industry

A precision die set manufacturing plant within easy reach of ALL Eastern industrial centers for faster, more thorough, direct service. Superior's highly qualified technical skill available at a moment's notice to iron out costly production delays in your plant.

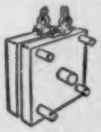
SUPERIOR die sets manufactured of quality materials . . . world-renowned for their long, accurate press runs. Speed-up handling from bench to press.

SUPERIOR offers complete engineering and manufacturing facilities at plants in Milwaukee and Plainville to produce *standard* or *special* die sets from the smallest to the largest. Over 33 years of manufacturing die sets to do your job BETTER, FASTER and at LESS COST.

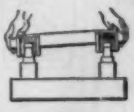
Exclusive SUPERIOR TIME and MONEY SAVING *Features*

SAFETY FLANGE
protects fingers by providing roomy gripping space on either side of the die shoe.

LOCK-JAW LIFTING DEVICE
removes the danger of handling large die sets.



E-Z LIFT SLING CHAIN
attach to the lock-jaw for immediate lifting.



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End troublesome binding in parting dies.

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WEST NEWTON, MASSACHUSETTS
Bigelow 4-2070

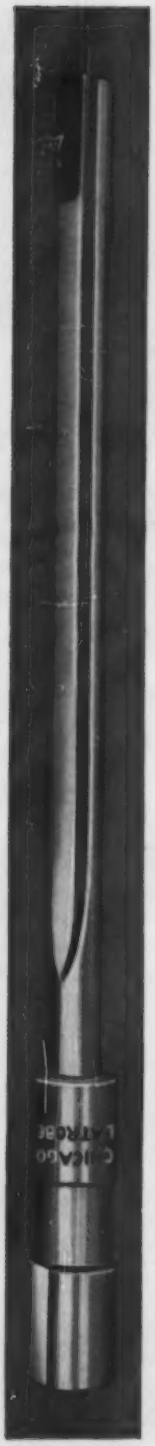
SUPERIOR STEEL PRODUCTS CORP. Eastern Division, Lewis Street, Plainville, Conn.

example will stand a much better chance of success than if he is just a good mechanic and nothing more. Foremanship is a branch of management, and management by example is the highest expression of that science.

If the boss makes a point of never taking liberties, very few of the men will be tempted to do so. I once worked for a boss who never took liberties, never took a cent from the company that he didn't earn. I never felt I could either. "Country" jobs in that shop were conspicuous only by their absence. I have always found a good mechanic who has given some proof of ability to lead, to be the best bet for promotion stakes. There are so many qualities we look for in a foreman—Al has indicated a few. My answer is, other things being equal, I prefer a good mechanic to boss a mechanical department.

Some unskilled administrators are very good, but they are rather exceptional. I happen to know of one such who started as a progress clerk with a British firm of pump makers and who eventually became works manager. A continental rival absorbed the British concern and the onetime progress clerk is, today, general manager. I'm often in touch with this exception and always admire his energy, his vision, his sheer tenacity of purpose. He is a fluent and interesting talker, a flattering listener, and has the gift of quickly spotting the essentials.

He once confided in me, leaving me in no doubt about his views on the importance of a mechanical training for one in his position. Somewhat wistfully he admitted, "I envy the man who got a good shop and drawing office apprenticeship. I take my



"All he did was suggest Chicago-Latrobe Gun Drills..."

More than one production man has pulled his shop out of a tough spot by discovering that Chicago-Latrobe gun drills offered a new and practical way to do certain difficult drilling jobs. Consult your Chicago-Latrobe distributor. He's had wide experience in this specialized field, and he has a C-L Service Engineer available to him who rates as the final authority on gun drilling.

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GUN DRILLS
WITH SOLID HEADS OR CARBIDE TIPPED
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"A new press just wasn't in the cards...

so we rebuilt this one and saved ourselves a lot of money!" And it can be done with any Bliss press. Bliss has developed 42 modernization "packages"—pre-engineered assemblies—all you need to make an old press act young again. Add faster clutches, modern adjustments, more compact gearing, greater capacity. Do it in *your* own plant to keep downtime at a minimum. Or have Bliss do a complete rebuilding job for you.

Which is better? It's up to you. We'll give you the facts, but it's up to you. For here at Bliss, we consider the sale but the beginning of our responsibility. Which is what we mean when we say, "Bliss is more than a name... it's a guarantee."

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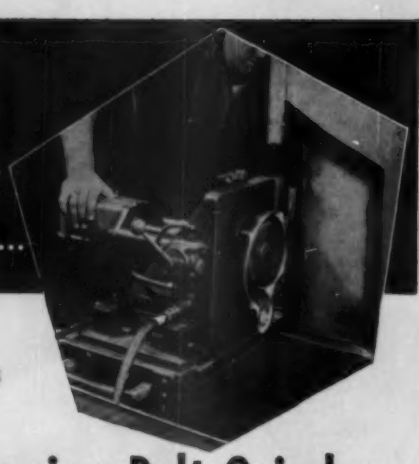
When shape and inaccessibility makes flat-surface machining of pump housings difficult...



Graymills Corp. cuts costs dramatically with an

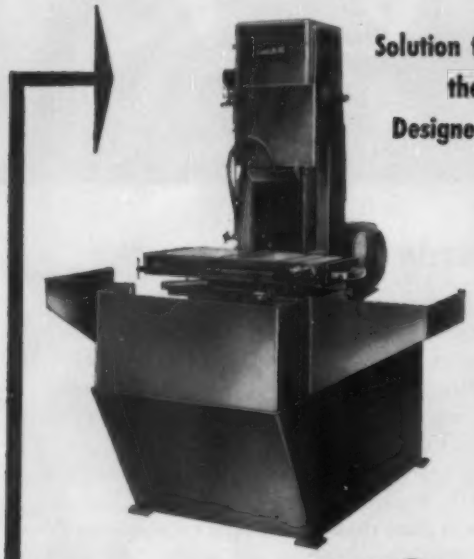
Engelberg Abrasive Belt Grinder

The shape of the intake-discharge housing on a Graymills immersion pump makes it unsuitable for surface milling or turning on a lathe. When either method is used, pump leakage results in as much as 10% of production runs, requiring corrective machining that pushes unit costs up.

Graymills installed an Engelberg platen type abrasive belt grinder, equipped with an automatic infeed table. To this machine (the BG8-FT9 described below) Graymills attached a draw-bar air fixture developed by their own engineers, designed to handle several sizes of castings with short run flexibility and minimum setup time.

Grinding rates on the grey metal pump castings are now considerably faster than alternative methods, in spite of a 1/32" stock removal. Very satisfactory belt life is obtained with 24-grit silicon carbide running at 5,000 s.f/m., cooled by a water-soluble chemical.

In the Graymills experience, Engelberg abrasive belt grinders again prove their adaptability to specific needs . . . adaptability that is limited only by the ingenuity of the engineers who program its use.



Solution to Graymills' Problem: the BG8A-FT9 Designed for Mass Production

● Fast machining by wet or dry abrasive belt, backed by ground steel platen. Presetting controls rate of feed and pressure. Quick approach of ball-bearing table is followed by slower, hydraulically controlled infeed down to Micro-Stop limit. Does fine tool room jobs of surfacing, squaring, grinding angles, bevels, radii, etc.

For complete information on this and other Engelberg Abrasive Belt Grinders, write . . .

The ENGELBERG HULLER Co., Inc.
381 Seneca St., Syracuse, N. Y.

ENGELBERG Precision ABRASIVE BELT GRINDERS

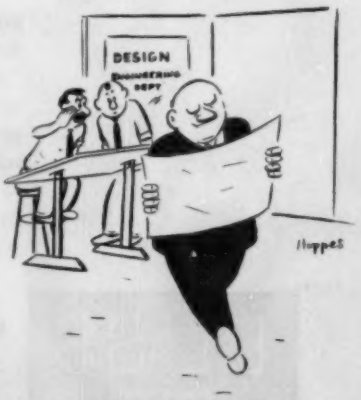
hat off to the man who had the brains and guts to add a degree to that." Good as he undeniably is, he feels he has cheated himself of something he ought to have.

A thorough apprenticeship training in mechanics and, at least, a nodding acquaintance with drawing definitely give a foreman "standing" with the men. That's a long stride forward toward complete control by consent. It makes for mutual respect and understanding. No matter how good an unskilled administrator may be, men who are skilled object to taking orders from the unskilled, and in the interests of shop harmony, I never ask them to. There are many other important, uncontroversial outlets in industry for the talents of the gifted unskilled; why look for trouble?

Donald Mack
Lanark, Scotland

THERE WAS A TIME when the super mechanic was chosen as a leader and foreman. The fellow who knew more about the machines and department was considered good foreman material. He did not have to know too much about the paper work. If he was a big bully who threw his weight around, so much the better. He could be a good man engineering-wise, but a blank, human-wise. His ace card was to threaten the employee with the loss of his job to get the work out. He was the dictator and you did what he said or else. He did not serve the employees, he served only management.

We must still recognize service, skill, and engineering ability in



"That's no machine design! That was a doodle!"

Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

For long runs and high polish they molded bowls with Lustre-Die

Our local tool steel distributor, Ford Steel Co., St. Louis, answered the question frankly. "If you're looking for high sheen on the finished product," they said, "and want a long-lasting die as well, we recommend Lustre-Die."

The die manufacturer, Lambert Engineering Co., St. Louis, put Lustre-Die to the test. They prepared the dies to produce plastic bowls used in a popular blender, for Chris Kaye Plastics Manufacturing Co., Madison, Ill. The result? Excellent die performance, and a fine looking product as well.

Lustre-Die is a really top-grade tool steel for making plastic parts because it has the properties which enable it to take an unbelievably bright polish. Lustre-Die not only has the proper basic analysis for working with plastics — we further improve it by alloy fortification, increasing its depth of hardenability and mechanical properties. It is heat-treated by oil-quenching and tempering, and is furnished ready for machining and polishing.

Lustre-Die is carefully made in the electric furnace. It undergoes close inspection to insure cleanliness. Moreover, it is free from injurious porosity or surface pitting.

Any way you look at it, Lustre-Die is fine tool steel, and a good performer. If you would like full information, check with your Bethlehem tool steel distributor.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

There's No Scorch With Proper Grinding

The redressing of worn tools by grinding is often done improperly. This causes a lower service life after regrinding than on the original grind.

The most common error in regrinding tools is the removal of metal so rapidly that the heat generated causes a "tempering back," or softening of the steel in areas which have been ground. Thus, the reground tool is softer in the working areas than it was originally, and therefore wears more rapidly. Abusive grinding is almost always accompanied by scorching, which produces purple, blue and yellow temper colors where the grinding has been done.

Many operators realize that the appearance of scorching is an indication of improper grinding, and they therefore make it a point to remove the scorched areas with a final, light grinding pass. This removes the visible evidence of scorch but does not remove the harmful effects. Tools which are being properly ground do not develop scorch in grinding.

USE CROMO-WV DISCS TO EXTRUDE ALUMINUM

This Bethlehem upset-forged disc, to be used in extruding aluminum, is made of Cromo-WV Hot-Work tool steel. Cromo-WV makes possible increased production of aluminum extrusions because it is resistant to heat-checking, and has adequate wear-resistance and toughness. Cromo-WV also responds accurately to heat-treatment. It's good tool steel — worth ordering for your next extrusion job.

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...the preferred Dial Indicators...

have forged cases, backs and wheel supports for maximum stability

Accurate measurements depend on the complete absence of interfering factors. That's why Ames Dial Indicators have forged cases, backs and wheel supports for maximum dimensional stability. The extreme care put into the design and material selection of component parts typifies the Ames approach to manufacturing a superlative product. It's just one of the reasons why the lifetime cost of Ames Dial Indicators is lower, and why so many quality control engineers specify Ames as "preferred". Write today for complete information.

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MANUFACTURERS OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

choice of leaders. This is not enough to qualify an employee to lead others. He must know how to correct wisely, control by suggestion, and influence others. He never reminds the employee that he is the boss. I can remember foremen I worked for, and their remarks, "Stop asking questions and get the work out." "Get to work, stop bellyaching." "I don't care what you think, get the job done."

They were the days when business was generally organized to get out the most amount of work for the least amount of pay. That is why we had organization of another sort. Labor banded together for a fair share of the profits and better working conditions. The thinking of supervisors was tempered by constantly being called up front. Business began to realize the fundamental good principles of human relations.

Bargaining between labor and management is essential in a democracy. It enables us to clarify common interests of boss and worker. It protects disagreement by creating respect for the other fellow's point of view. We must have supervisors who are human and who can settle grievances on their own level. We don't want to return to the attitude, "It is no use talking to the boss."

A E Salmons
Norristown, Penna

Of course, every foreman should be a super mechanic, but the trouble is that there are not enough of such rare birds available. However, if supermen cannot be hired as foremen, they should at least be ordinary tradesmen. Any foreman should be

"Good thing the company don't have to pay the boss overtime . . . They'd go broke inside of six months!"

Advanced Design McKay Mill Sets Pipe Production Records At J&L

New era in pipe production comes of age as McKay incorporates oil cooled transformer, continuous visual recording of weld pressure and induction seam annealing, automatic control of weld speed and heat and synchronization of cut-off in large resistance weld pipe mill.

RECENTLY Jones & Laughlin Steel Corporation set into operation their new McKay Pipe Mill capable of producing 150 feet of 12¾" OD electricweld pipe every minute. More important than the speed, according to J & L officials, is the quality of the product. McKay's forced oil cooled transformer assures more pipe per kilowatt hour. It is the first 2400V transformer designed for continuous operation at frequencies up to 180 cycles.

Hydraulic load cells measure forging and electrode pressures at the weld zone. Weld speed and heat are controlled with precision to assure the most uniform welds possible at any speed with no readjustment necessary. Continuous seam annealing assures uniform ductility of pipe, and for the first time synchronized cut-off has been successfully adapted to a large mill. The mill has several other advanced innovations applied to a line this size for the first time. To get all the facts talk with a McKay engineer soon.

McK

THE McKAY MACHINE COMPANY
YOUNGSTOWN, OHIO

No. 343

Vickers Magnaclutch for Better Torque Transmission

it's a job for CDT

Faced with a special tooling job? Stymied by a tough problem? Would 50 years of experience help? Then the logical answer for you is to send it to Columbus Die-Tool! CDT specializes in tools, jigs, fixtures and also special machinery, designed and built to produce your products better, faster, and more economically.

That's why so many of the nation's leading manufacturers avail themselves of the specialized services of Columbus Die-Tool. Perhaps CDT can solve your tooling problem and help you make your product . . . better for less.

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Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

an expert on the know-how in his own department.

I don't think a man is suitable to lead the work in a shop just because he is said to be an organizer or administrator. If such a guy must ask somebody else to clear out most problems arising every day in any production activity, I don't think he will be respected. Only the owner of a business in this line of work or the relatives of some high brass can get away with ignorance in mechanical activities.

If the foreman in a shop is mostly tied down to paper work in his office, that shop should be reorganized. A foreman's prime duties should be to direct activities so that something happens in production every minute of the workday. He should also be safety minded so that he does not give orders that would bring his helpers into accidents.

It is true that different kinds of foremen are needed for different kinds of production. In a factory department where only a few mass-production operations are carried out, perhaps a man who is not a real tradesman will do if he has some initiative and courage. In the small shop, with mixed production, where many types of trades are represented, a compromise of the demands of the foreman's ability as an expert on all sorts of mechanical activities in that workplace must be accepted.

But on the whole, every foreman should be a good craftsman in at least one of the mechanical trades. It is up to management to develop young men in the trades represented in each kind of production, so that when a foreman is about to be appointed, there is a suitable man ready to step in.

An asset to any foreman's worth is

"I'm wearing elevator shoes."

Vickers Magneclutch for Better Torque Transmission . . .

VICKERS®

Magneclutch®

solves difficult tension control problem in slitting machine operation

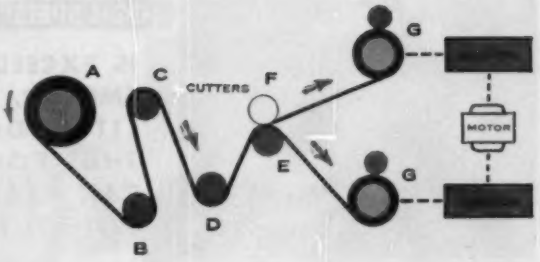
This specialized machine by Gudeman Company of Chelsea, Michigan, slits mil-thick materials such as paper and metal foil for use in capacitors.

As the feed roll is unrolled, slit and rewound, the tension on the material as it passes through the slitting knives and rollers must be accurately controlled, to assure uniform rewinding and to prevent strains, breakage or snarling.

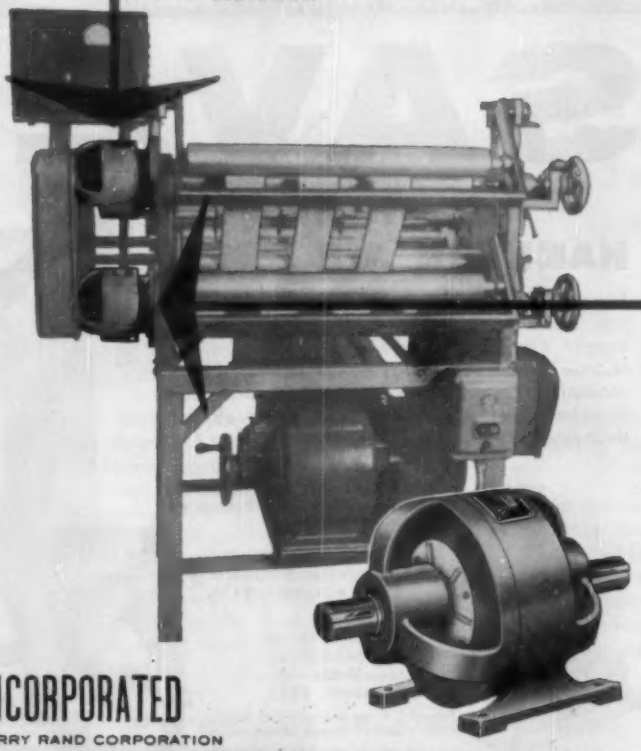
The manufacturer was able to obtain this necessary tension control independent of speed only with the Vickers Magneclutch, after mechanical clutches had failed because of changing characteristics and difficulty in adjusting to changing tension demands.

This, of course, is only one of many practical uses for the Magneclutch, the magnetic particle clutch that provides smooth operation without grab or chatter, torque at zero slip, fast response, and long life because there's no wear on torque transmitting surfaces.

Write for complete information and literature.



Rollers B, C and D pull the material from the unwind roll and establish the speed at which the material flows through the machine. The torque transmitted by the Magneclutch establishes the tension in the material between roller D and roller G. As the diameter of the windup roll increases, the clutch slips automatically, permitting the material to wind up at a constant speed and tension.



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IS EXCEEDINGLY FAST, SMOOTH, INVOLVES SO LITTLE DOWN-DRAG THAT FORMED PARTS CAN READILY BE CUT WITHOUT ANY REST

Tremendous time and cost savings, in cutting sheet steel, formed or flat, trimming malleable and steel castings and similar operations, are available to you with these machines.
Get the facts. Ask for FREE copy of "FRICTION SAWING."

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TANNEWITZ DIE-SAWS
24", 36", 48", 60" CAPACITIES
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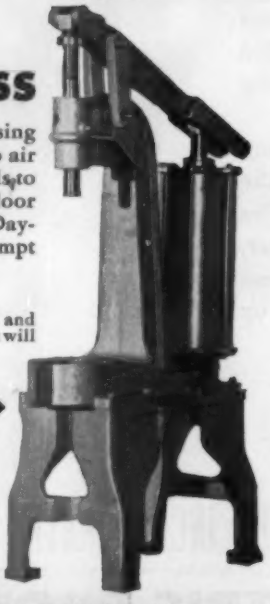
SAWING MACHINERY SPECIALISTS

SAVE!

WITH A HANNIFIN AIR PRESS

It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.



WRITE. Complete information and prices on Hannifin Air Presses will be sent on request.

6 Tons (Model B-2) One of more than 30 models. Press with base, $570.

1-ton Hand-D-Press. For small parts manufacturers. Press only, without valves, $230.

Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

HANNIFIN

HANNIFIN COMPANY, 517 S. WOLF ROAD, DES PLAINES, ILLINOIS

his knowledge in engineering rather than in types of organization systems. How a shop should be run is up to management to decide. The only thing a foreman can do about the organization is to point out difficulties arising as a result of some transactions included in each system.

Another asset to a foreman is his ability to understand the psychological effect of his orders and the way they are given. He should be able to cooperate in spite of misunderstandings and difficulties and not get angry if things go against him. He should give due credit for good work and overlook minor offences. He should encourage every effort to increase production, and he must act so that at least the majority of his workers are with him and not against him. A good way to be accepted by the fellows under him is to inquire individually about a man's and his family's health, and occasionally pull a joke to bring out a good laugh; such things make a fellow feel happy and contented.

It is a plus to any foreman's ability to handle questions raised by the union, but he need not worry about contracts agreed upon, or any other important problem. It is up to management to take care of this. No foreman in factories where mass production is done need do any manual work himself, but in the smaller shops perhaps he occasionally must show his helpers how to do things. Proper instructions may sometimes include manual work there.

While it is possible for a foreman to use a skilled mechanic for certain boss jobs where he himself is not an expert, he cannot judge if his men properly carry out the orders he gives them. "A blind man cannot lead another blind man, lest they both fall into the pit." No, the foreman must be able to see what is to be done and how it should be done.

A E Fristedt
Stockholm-Bromma, Sweden

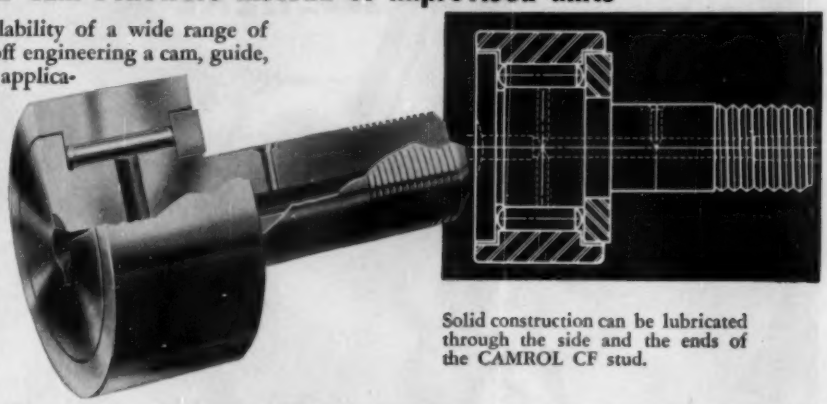
"I'm afraid you don't understand what we mean by 'operator.'"

BEARING TIPS by McGill

For convenience, with savings in time and cost

Use McGILL® CAMROL Cam Followers instead of improvised units

Simplification of design with availability of a wide range of standard bearings takes the strain off engineering a cam, guide, support or track roller bearing application. No need to "build up" a special unit when you can select the proper size standard CAMROL bearing engineered especially for the job. McGill's CAMROL bearing construction offers full type capacity, with provision for shock, in a compact precision unit. Specify CAMROL, the original cam follower, in either CF (with stud) or CYR (shaft mounting) series. Sealed and prelubricated bearing available also.



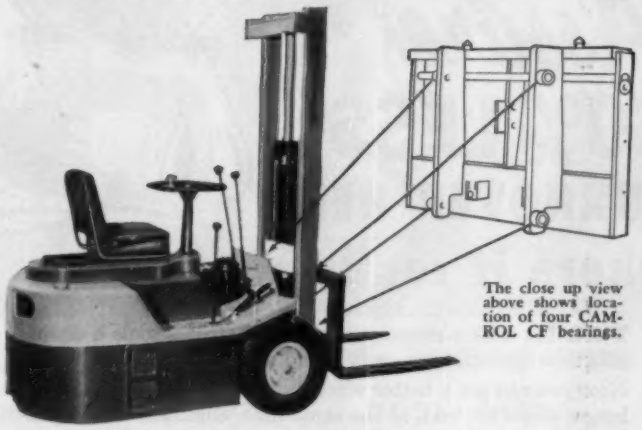
Solid construction can be lubricated through the side and the ends of the CAMROL CF stud.

CAMROL® YR bearings help F-100 Super Sabre make slower and safer landing

The supersonic speeds obtained by today's modern aircraft set up design problems not encountered with older, slower planes. The overall streamlined design required for speed in flight, for instance, necessitated finding ways of supporting the North American F-100 Super Sabre at low air speeds required for landing. A

series of slats on the leading edge of the wing, providing greater lift at lower air speed, was the answer. Each slat is supported by McGill CAMROL YR bearings — especially designed to permit shaft or yoke mounting. These long-life bearings carry the loads of these slats as they move on tracks during flight of the Supersonic F-100.

CAMROL® CF bearings out-perform friction rollers as fork support bearings



The close up view above shows location of four CAMROL CF bearings.

Small size and high load-carrying unit construction with simplified lubrication are among principal benefits obtained by Hyster Company from use of CAMROL CF bearings as fork support rollers in its Hyster 20 and other lift trucks.

Two bearings ride up and down inside each vertical mast section to position the lift truck fork under load. Speeds are relatively slow but the crushing loads on each bearing are heavy.

In this particular application, the exterior surfaces of the bearings are treated with a black oxide finish. This provides corrosion-resistance which serves to augment maintenance-free operation, a characteristic of CAMROL bearing construction.

Fact-packed Bearing Catalog

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J. K. Smit are also manufacturers of diamond tools, diamond wheels, diamond drill bits, diamond lapping compound and diamond powder.

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NAMES IN THE NEWS...

Charles E Verkler, assistant manufacturing manager of Caterpillar Tractor Co's Peoria plant, has been promoted to manufacturing manager

Edwin R Broden, president of SKF Industries, has been named, in addition, chairman of the board. He succeeds **Richard H DeMott** who has resigned.

Alvin J Jones, formerly chief engineer of Landis Tool Co, Waynesboro, Penna, has joined Motch & Merryweather Machinery Co as director of engineering.

Don A Jackson has been promoted to factory manager of Wallace Barnes Co, Ltd, Hamilton, Ont, subsidiary of Associated Spring Corp. Formerly head of the estimating and planning department, he succeeds **Douglas Park,** named purchasing agent of Associated Spring's B-G-R division at Plymouth, Mich.

W F Kruspe, executive vice president of Valvair Corp-Sinclair-Collins Valve Co, has been named president and general manager of the company to succeed **J E Collins,** elected board chairman.

F C Berliner has been named vice president of Maysteel Products, Inc, Milwaukee. He will continue to serve as sales manager.

Leonard M Clark, sales manager of Snap-Tite, Inc, Union City, Penna, manufacturer of couplings, has been named vice president. **George F Hagger,** director of engineering, has been appointed vice president, engineering.

P W Brown has been elected president of the California Metal Trades

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Starrett Flat Stock and Die Stock
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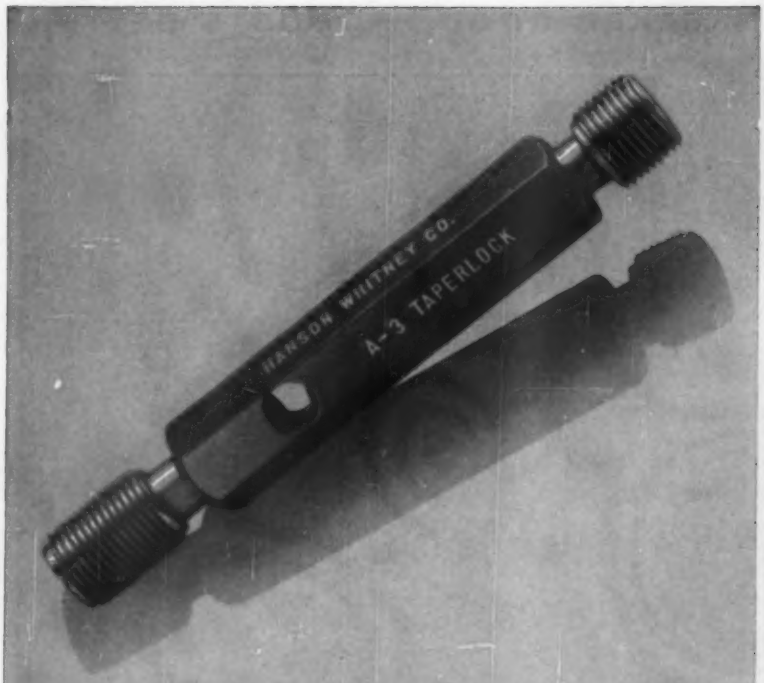

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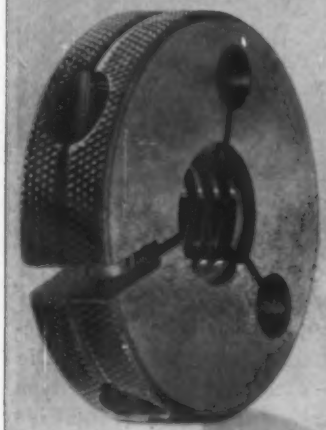
Hanson-Whitney has long led the field in the production of top quality Finished Taps, Hobs, Cutters, and Precision Gages. And H-W offers complete stocks and service from local distributors . . . plus home or field engineering assistance on all threading problems.



Hanson-Whitney Gages are engineered and manufactured with "single source" reliability and accuracy. H-W Limit Working Plug and Ring Gages are available in all standard sizes, National and Unified, and all special forms. H-W offers AGD Cylindrical and Thread Plug and Ring Gages, straight and tapered thread, in steel and carbide. In addition, H-W manufactures a complete line of comparator type, internal and external thread gages.

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TAPS : THREAD GAGES : HOBS : CENTERING MACHINES : THREAD MILLING MACHINES AND CUTTERS

Association for 1957-58. Mr Brown is president and general manager of Mathews Conveyor Co, West Coast, San Leandro. Other officers are **Earl D Brodie**, vice president of Ralph N Brodie Co, San Leandro, 1st vice president; and **E N Meakin**, president of California Press Manufacturing Co, San Francisco, 2nd vice president.

John E Rowe, formerly vice president of Ross Operating Valve Co, Detroit, has joined Tomkins-Johnson, Jackson, Mich, manufacturer of air and hydraulic equipment as executive vice president. **William J Remund** has been promoted from sales manager to vice president, sales.

E P Berg, general manager of Link-Belt Co's Pershing Road Plant, Chicago, has been elected president of the Conveyor Equipment Manufacturers Association. **J B Nordholt, Jr**, president of Webster Manufacturing, Inc, Tiffin, Ohio, has been named vice president.

C T Stott, assistant general manager of Bethlehem Steel Co's Sparrows Point, Md, plant, has been named general manager to succeed **C E Clarke**, who has retired.

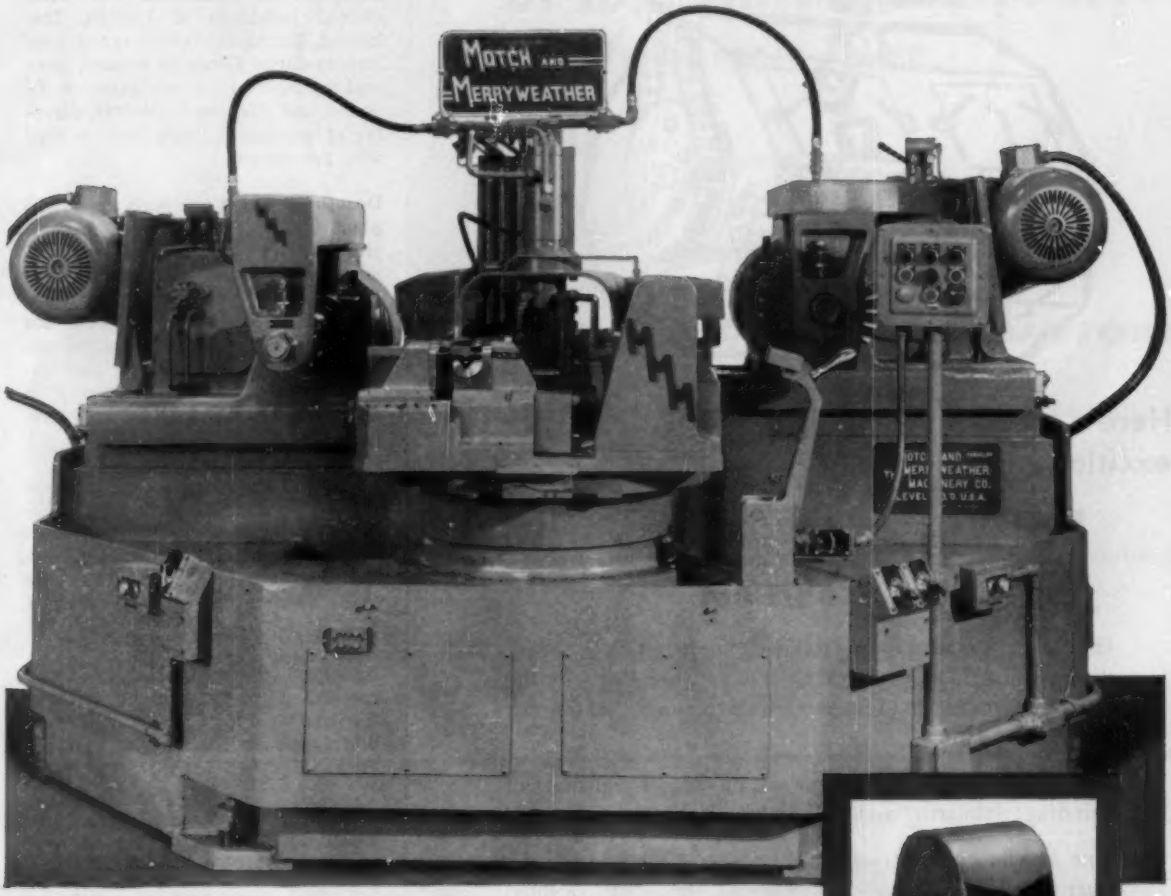
Douglas C Albright has been named manager of manufacturing for the Building Products Division of American Welding & Manufacturing Co, Warren and Niles, Ohio. He was formerly assistant to the vice president, manufacturing, at the Crane Co, Chicago.

Paul Fisher, chief methods engineer, has been promoted to the post of manager of Hyster Co's Portland, Ore, manufacturing plant. **Fay Brainard**, special engineering assistant to management, takes over Mr Fisher's former post.

George F McCarthy, formerly associated with Holliday-Hathaway Co, has joined Bowmar Instrument Corp of Fort Wayne, Ind, as general sales manager. Mr McCarthy, who will make his headquarters at Great Neck, NY, will be in charge of all phases of the sales program for both the Electromechanical and the Counter Divisions of the company.

William A Kerr has been appointed general sales manager of Baldwin-Lima-Hamilton Corp's Electronics & Instrumentation Division, Waltham, Mass. Mr Kerr was formerly associated with Tracerlab, Inc, also in

Another specialized machine by M & M



Special duplex milling machine

for milling and slotting chain links

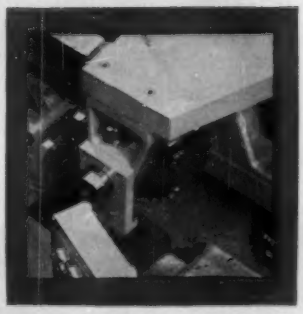
Operation—Straddle and form mill on right hand station, slot or straddle mill on left hand station.

Universal—Six different sized parts run over this machine.

Cycle—Either automatic or manual cycle. Cycle time, 64 seconds.

Feed—Custom-designed and built hydraulic head feed, index and clamp.

Fixtures—Four fixtures are mounted on index table.



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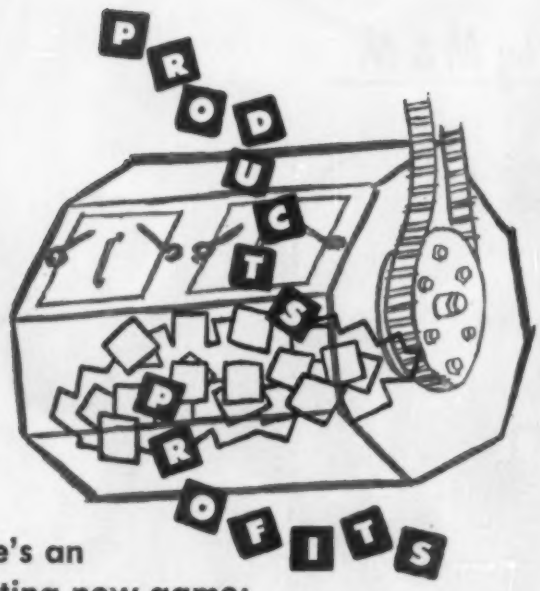

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Waltham, as vice president and general manager of the company's Nuclear Divisions.

Lafayette E Hammond has been elected president of Lehigh, Inc, Easton, Penna, manufacturer of gray iron castings. **Leroy M Bissett,** general manager of the refrigeration division, and **Clayton L Coulter,** director of purchases, have been named vice presidents.

Dorothy P Vogel has been appointed plant manager of Colvin Laboratories, Inc, East Orange, NJ, engineer and manufacturer of pressure and displacement transducers and other electro-mechanical instruments for missiles, aircraft, and industrial automation. An officer of the corporation, Miss Vogel was formerly in charge of the production and planning department.

Ernest R Howard has joined the Truflex Thermostat Metals sales and engineering staff of the General Plate Division of Metals & Controls Corp. He was formerly associated with Wade Electric Products, Sturgis, Mich.

Nat Paschall, vice president, commercial sales, for Douglas Aircraft Co, Santa Monica, Calif, will now direct all sales activities of the company.

Denzil Hawkins of Dayton and **Theodore Rancont** of Detroit have been named vice presidents of the Producto Corp, Detroit distributor of Producto diesets, die accessories, and toolroom equipment. Both men are branch managers in their respective cities and will continue to serve in those capacities.

Robert W Carlson, vice president and general manager of Minnesota Rubber & Gasket Co, Minneapolis, has been elected president, succeeding **George E Carlson,** named board chairman.

Paul Y Chamberlin has been named plant manager of Michigan Panelyte Molded Plastics, Inc, Dexter, Mich, division of St Regis Paper Co. He had been serving as production control supervisor at St Jean, Quebec.

Fred H Angier has been named sales manager of the newly formed Hydraulics Division of Dalmo Victor Co, Belmont, Calif. Prior to his promotion he was assistant sales manager for the eastern region, with headquarters in Washington, DC.

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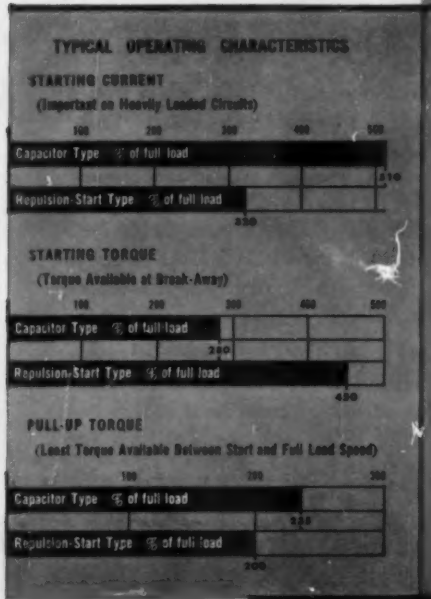

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Pay Of College Teachers... Where The Russians Are The Capitalists

This editorial deals with a simple question about college faculty salaries: Which country pays its teachers better, Russia or the United States? It's a good question, with a sadly embarrassing answer.

That American college and university teachers are underpaid is not a novel observation. But what has happened to the economic status of their profession can be put in more candid terms. **As far as financial incentives are concerned, we have virtually socialized the academic profession.** Teaching has become such a poorly paid career, with so little prospect of material reward for outstanding performance, that it simply does not attract enough highly qualified young men and women.

Ironically, the Soviet Union has deliberately and successfully used capitalist incentives to improve its educational system. Although the Russians show an utter disregard of civil liberties, they pay their teachers well and confer on them all the prestige and privileges the Soviet society can offer. Russian professors, together with party officials and scientists, have become the privileged upper class of a supposedly classless society.

Incentives To Be A Teacher

To be a college teacher requires high intellectual competence and long, sometimes costly, formal training. Aside from the appeal of academic life, what incentive does college teaching offer bright young men and women?

In the U. S., the average faculty salary is little more than the average income of industrial workers. According to the National Education Association, the average faculty salary is about $5,240. College instructors receive $4,100, associate professors $5,730 and full professors $7,100. The average income of U. S. factory workers in 1956 was $4,580.

Actually, workers in many industries — steel, automobile and petroleum, for example—earn more on the average than college teachers. And skilled workers often earn more than full professors at some of our colleges and universities.

In Russia, on the other hand, the young Soviet graduate can see that it pays — and pays very well — to choose teaching as a career. The head of a department in a Russian university can command a salary of about 6,000 rubles a month.* This is about eight times the income of the average Russian worker, who earns 750 rubles a month.

The Russian professor comes off very well in terms of what his income will buy. It has been estimated that, based on Soviet consumption patterns, 6,000 rubles a month is worth about $7,200 a year — or higher than the average professor's salary in the U. S. Of course, it is difficult to compare living standards in two countries as different as the U. S. and Russia. But particularly in the field of science — where the salaries can run to 15,000 or more rubles a month — it is clear that the Soviet professor enjoys a higher real income than that offered his American counterpart by a much more prosperous economy.

Incentives To Be A GOOD Teacher

Russia also offers much higher premiums than the U. S. to those who attain distinction in teaching. Teachers at the university level earn significantly more than teachers in high schools, and university instructors can look forward to a sharply progressive rise in earning power as they

* *Soviet Education for Science and Technology* by Alexander Korol of the M.I.T. Center for International Studies.

How Faculty Salaries Compare With Industrial Wages

(Worker's Wage In Each Country = 100)

*Sources: Center for International Studies, M.I.T.; National Education Association; McGraw-Hill Department of Economics

advance to higher positions. The spread between the income of a full professor and the lowest academic position is greater than fifteen to one. In addition, full professors can earn a healthy bonus if they are elected to membership in the Russian Academy of Sciences.

In the U. S., by contrast, full professors on the average earn less than twice as much as beginning instructors. And many college professors earn less than public school teachers in large cities. Even a full professor's pay does not compare with earnings in other professions or in positions in industry requiring similar training. The point was well summarized in a recent speech by Marion B. Folsom, Secretary of Health, Education and Welfare: "It is nothing short of a national disgrace that we are discouraging people who want to teach by offering salaries that are far below the levels justified by their training and far below the levels which others are willing to pay."

Our colleges and universities, as well as our teachers, find themselves in a serious predicament. Faced with a shortage of both funds and teachers, they cannot reward distinguished performances. Limited resources for salary increases have gone predominantly to the lower ranks, so that an adequate number of teachers could be retained. Meanwhile, potentially fine teachers are being siphoned off into better paid occupations.

The shabby treatment of our teachers threatens to undermine, not only our educational standards, but our free enterprise system itself. There is the recent example of a liberal arts college which discovered that five of its graduating seniors were being offered starting salaries higher than those paid any of their professors. It would be surprising if experiences like this did not place a strain on the enthusiasm with which these professors deal with some key aspects of American capitalism.

Also important is the role education is playing in the cold war with the Soviet Union. The Russians have made great strides in raising the quality of their education — particularly in science and engineering. Both the number and the technical calibre of their graduates are impressive, as recent Soviet achievements testify. These successes owe much to the generous economic treatment the Russians have given their teaching profession.

A Standard For Faculty Pay

Earlier editorials in this series have outlined various ways American business can help relieve the financial plight of our colleges and universities. They have suggested that private contributions to higher education should average at least $400 million a year over the next ten years if faculty salaries are to be raised to adequate levels and our colleges are to be able to meet increasing operating costs.

Another standard for raising faculty salaries proposed by an American businessman is this: "When a teacher's income gets up to a point where you will suggest to your boy that he ought to give some thought to teaching as a profession, then we may be approaching the right figure."

Russia clearly has set her teaching salaries well above the "right" figure. We are nowhere near it. What this adds up to is that the Communists — not we — have become the shrewd capitalists in the vital field of education.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw

PRESIDENT

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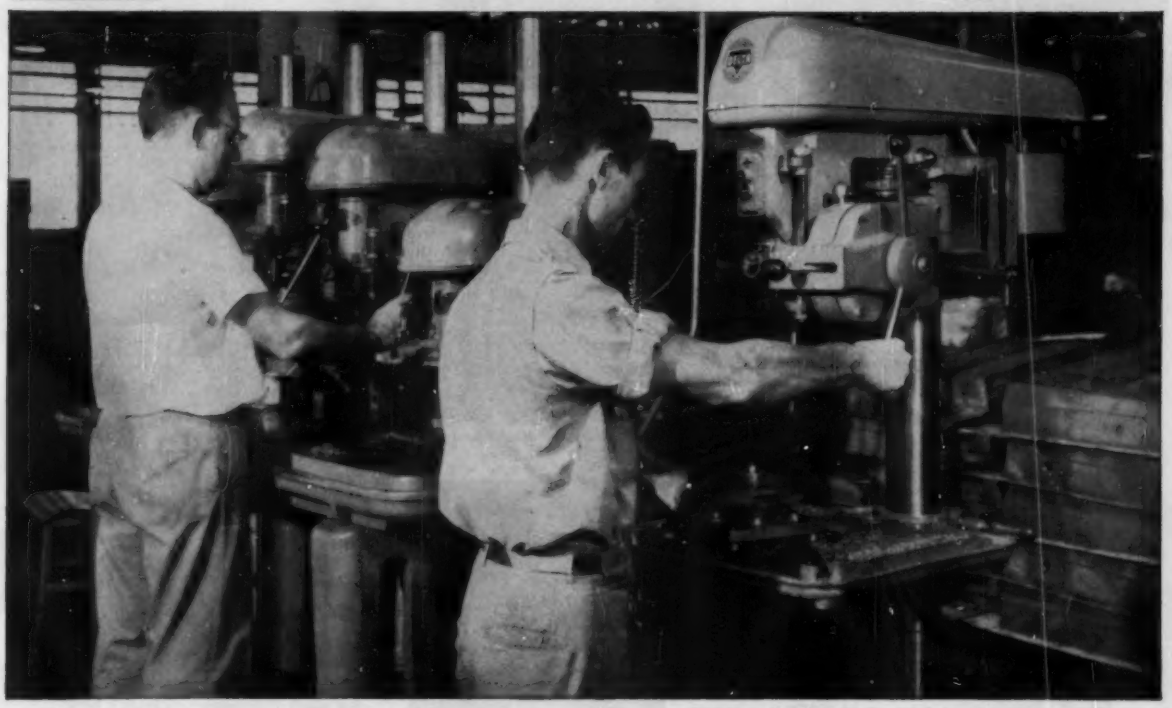

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Typical parts machined on the TYPE 4600

Typical operations performed on TYPE "P" Semi-Automatic Pointing Machines

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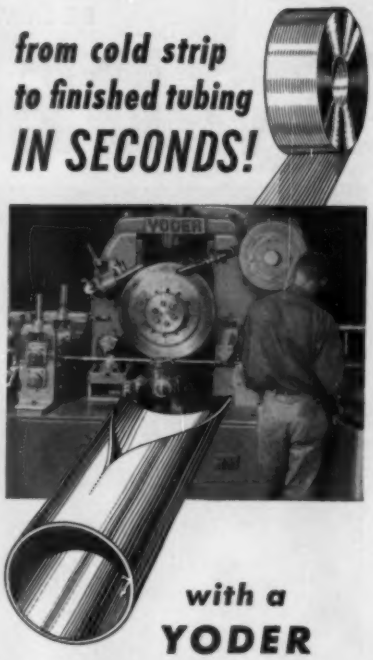

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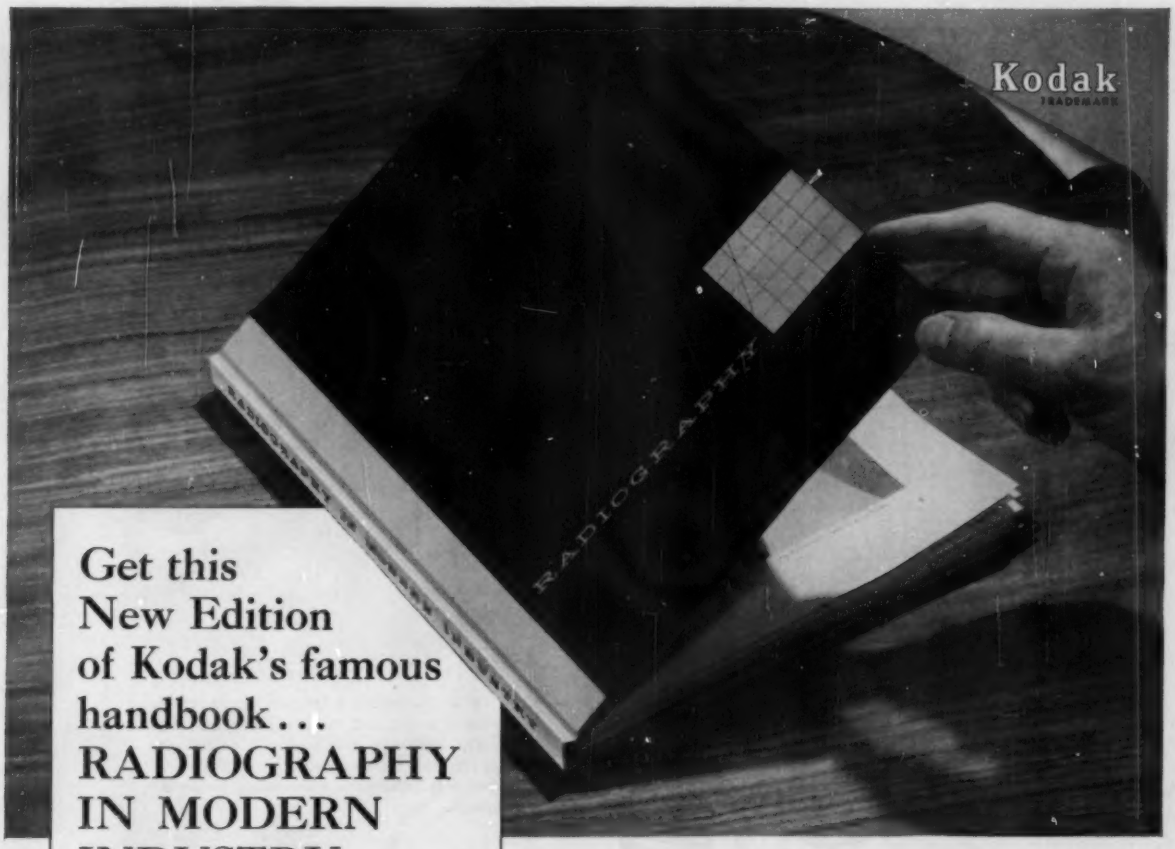

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Flying finish for jet engine parts

...10 times as fast with precision OSBORN Brushamatic® Methods

JET ENGINE COMPONENTS *are precision finished automatically at high production rates on Osborn Brushamatic® 51-OOL Machine.*

HERE'S how a jet engine manufacturer has broken a production bottleneck . . . saved dollars and days in the precision-finishing of jet engine components . . . with Osborn Brushamatic® Methods.

Sharp edges, burrs or scratches on components cause stress concentrations and resulting fractures—so a high degree of surface refinement is essential. *Tedious hand finishing each of these parts used to take 80 minutes.* Still, job quality was inconsistent . . . costly in time and money.

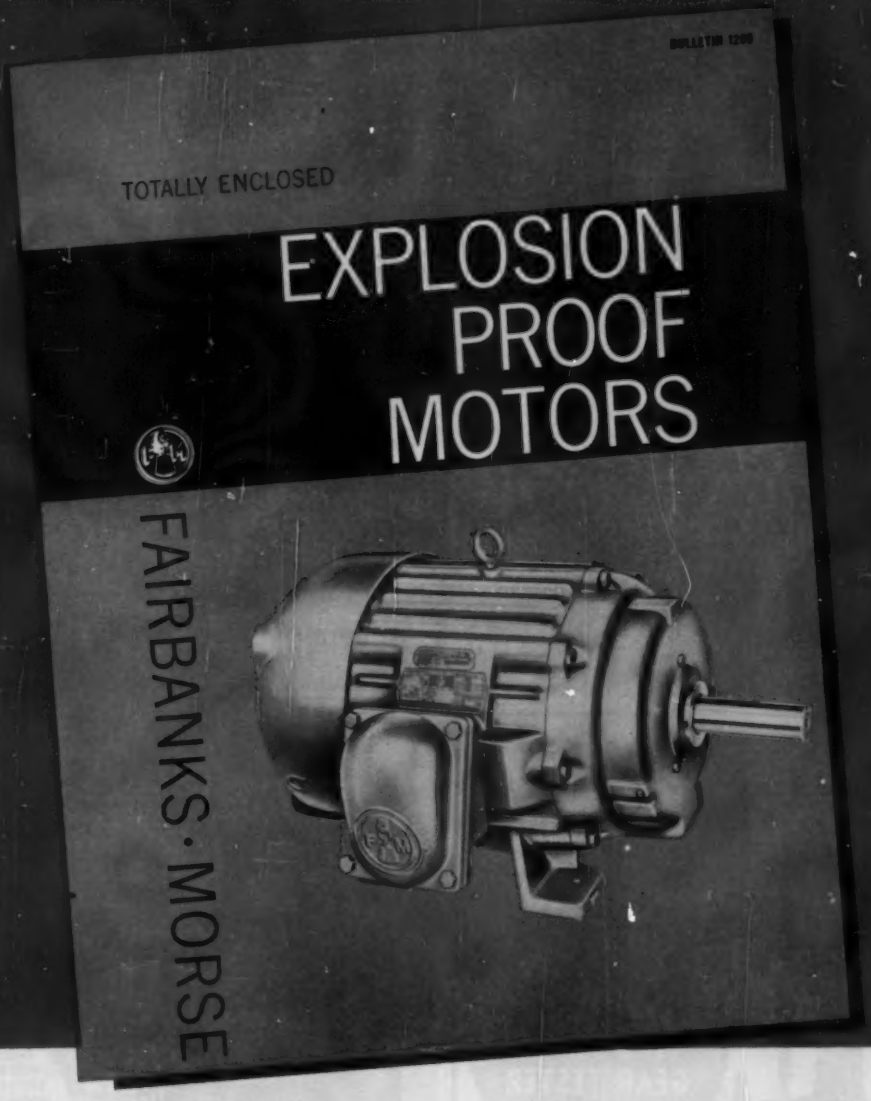
Today, Osborn Brushamatic does the same job in 8 minutes . . . 10 times as fast . . . with a high-quality, uniform finish held to micro-inch specifications.

It's typical of how Osborn Power Brushing works to help *you* speed production . . . cut costs . . . improve product quality. An **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, will show you how. Write us for details—and for your copy of the 20-page Brushamatic® booklet. *The Osborn Manufacturing Company, Dept. C-65, Cleveland 14, Ohio.*

Osborn Brushes

BRUSHING MACHINES • BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • FOUNDRY PRODUCTION MACHINERY

NEWEST MOTOR TO CARRY UNDERWRITERS' LABEL



FAIRBANKS-MORSE

EXPLOSION PROOF

All new inside and out—new, rugged frame design . . . for new, improved performance in all Class I, Group D, and Class II, Group E, F and G hazardous locations.

Get full information . . . send for Bulletin 1200 on new Fairbanks-Morse line of totally enclosed, explosion-proof motors. Write today: Fairbanks, Morse & Co., Dept. AM-12-16, Chicago 5, Ill.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • PUMPS • SCALES • RAIL CARS • HOME WATER SERVICE EQUIPMENT • MAGNETOS

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Precision High Speed Lathe Type D 10
with headscrew and Feed Rod

reliable
efficient
low cost

Height of centers 180 and 200 mm
Distance between centers, 1000, 1500 and 2000 mm

manufactured according to the accepted standards for toolmakers' lathes DIN 8605

MATRA-WERKE · GMBH · FRANKFURT/M.

PRECISION GEARS?

ROLL TEST THEM
RAPIDLY
ACCURATELY
with the

SCHERR
5" CENTER DISTANCE
FINE PITCH
GEAR TESTER

Fine Pitch Precision Gears are quickly tested for runout of Pitch Diameter, Spacing and Tooth Form Errors.

Scale Vernier:
.0005" Indicator Readings

The New Model is equipped with adjustment of measuring pressure from 4 ounces to 2 pounds

OTHER SIZES OF GEAR TESTERS AVAILABLE UP TO 36".

Send for Illustrated Folder - Code GIKNA

GEORGE SCHERR CO., Inc.
COMPLETE LINE OF PRECISION INSTRUMENTS
200AM LAFAYETTE STREET • NEW YORK 12, N.Y.

DAVIS KEYSEATER

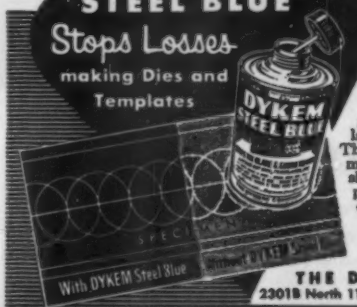
This low cost machine will handle internal keyseating jobs up to 1 in.

Write for illustrated bulletin.

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

DYKEM STEEL BLUE

Stops Losses making Dies and Templates



Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301B North 11th St. • St. Louis 6, Mo.

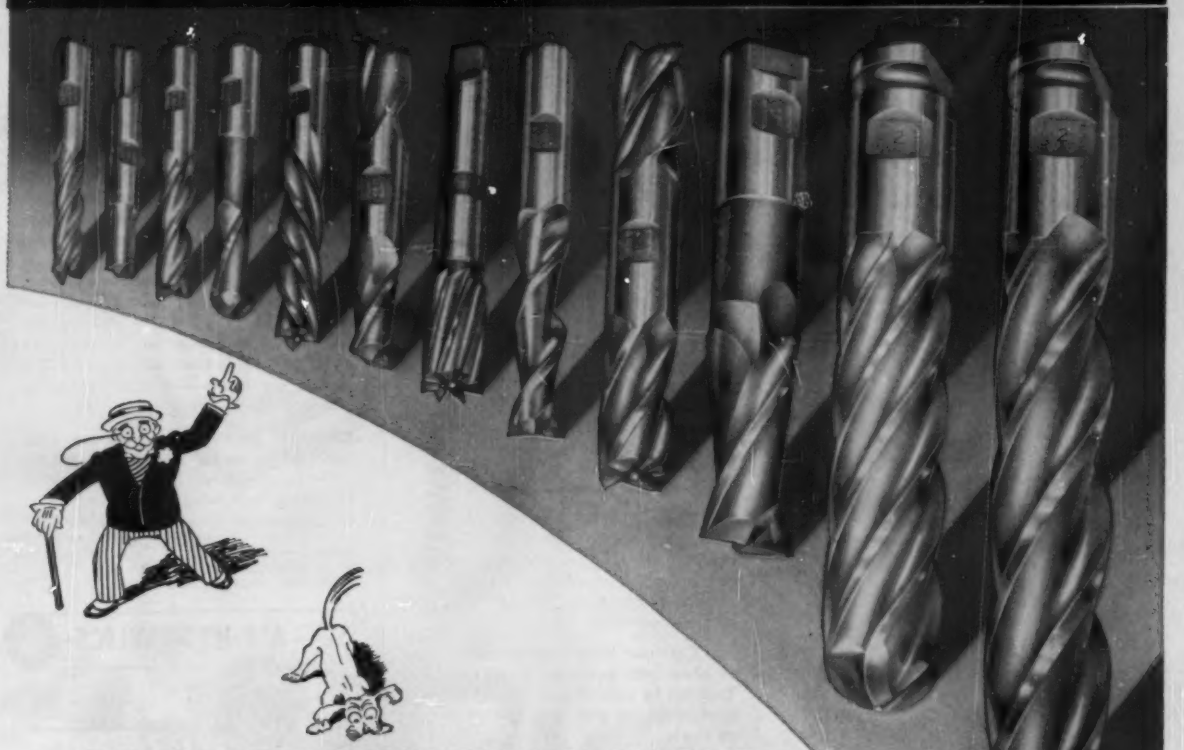
CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301B NORTH 11TH ST., ST. LOUIS 6, MO.

END MILLS ARE OUR BUSINESS . . .
NOT A SIDELINE



TO BEST SERVE YOUR NEEDS

For over twenty years our designing and manufacturing abilities have been devoted to producing highest quality end mills. Because end mills are our business, we realize that universal acceptance of our product is obtained and maintained by continuously supplying the best end mills available.

Putnam manufactures and stocks over 1400 standard types and sizes of end mills. Thus, you can quickly and economically select the exact size and type to best meet your needs.

Putnam Distributors from Coast-to-Coast carry large stocks of standard end mills. Contact your neighbor, the local Putnam Distributor, he will recommend the best end mill for specific jobs, give you personalized service, and quickly supply your needs with the finest end mills obtainable.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVENUE · DETROIT 7, MICHIGAN

COGSDILL BURRAWAY

tools give you the edge ⟶ on time

A matter of seconds is all it takes to deburr both faces of any hole completely in one quick in-and-out action with the Cogsdill BurrAway Tool.

Take a new look at your deburring operations. Have you a job which requires two separate operations because you have to deburr or chamfer both surfaces around one hole?

Call our local representative to show you how this BurrAway Tool can be used in your particular equipment, to give *you* the edge on time.

Cogsdill

TOOL PRODUCTS, INC.

12980 W. Eight Mile Road, Oak Park 37, Michigan

From the *American Machinist* Library of *Tips for Top Shop Men*

AN invisible boss presides over every collective bargaining session. He is not labor, management, or government—but is the customer, who exercises power of selection over your company's products.

AIR-HYDRAULICS

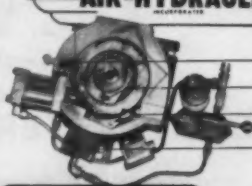
CUSHIONED STOP . . . FOR ACCURATE INDEX

HERE'S YOUR ANSWER, if accuracy and dependability are important to you. Cushioned stop eases work to position. Locking cylinder stops the table "on the money" and holds it until released by locking dog. Changes in loads, diameters or speeds are no problem either, since both speed and cushion are adjustable. Top plate is 15" in diameter but the rugged mechanism will handle much larger work loads. Table will make up to 100 indexes per minute with a 22" diameter, 200 lb. load.

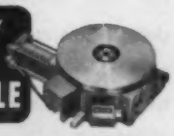
OPERATES on 60-175 lbs. pressure when equipped for air but table is available for either air or hydraulic operation. 4, 6, 8, or 12 stations are standard but others, up to 30, are made to order.

REPRESENTATIVES: SOME TERRITORIES STILL OPEN. WRITE FOR INFORMATION.

AIR-HYDRAULICS



HEAVY DUTY **air INDEX TABLE**



NO BACKLASH, SKIPS, OVERRUNS

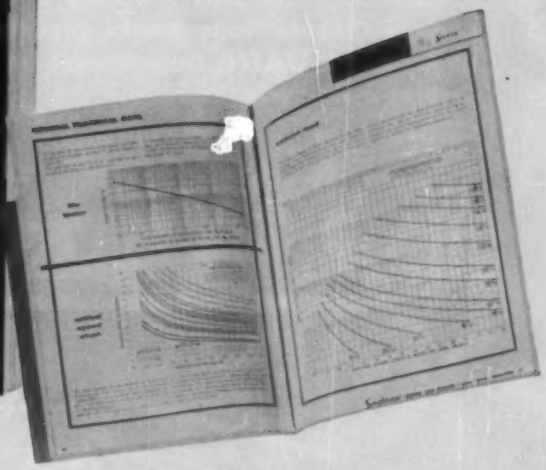
THE REASONS are simple but important: • Positive index, because the index pin shifts to the new position while table is stationary and is only disengaged by locking dog after indexing • Locking cylinder insures firm seating of dog in ring notch • Cushion stop eliminates wracking jar • Two versatile sizes • Table surface is ground for accuracy • May be mounted vertically or horizontally on all types of presses or other tools where accuracy of register is imperative • Operates on line pressure from 60-175 lbs.

OUR 8 PAGE CATALOG covering presses, hammers, index tables and allied equipment is ready for you now. Write for yours today.

AIR-HYDRAULICS

202 HUPP AVENUE
JACKSON, MICHIGAN

Here are the ANSWERS to your most PERPLEXING ACTUATION AND TORQUE PROBLEMS!



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NEW 1958 ENGINEERING DATA BOOK and STANDARD ASSEMBLIES PRICE LIST

from world's largest producer of b/b screws and splines

36 PAGES CRAMMED WITH FACTS!

Basic Operation • Applications • Advantages • Features Characteristics • Technical Data • Standard and Custom-Designed Assemblies • Couplings • Design Data • Engineering Assistance Facilities and Service • Save time, trouble and money by getting the full facts now on Saginaw b/b Screws and Splines that save power, weight and space—often help solve "impossible" problems!

Saginaw ball bearing Screws & Splines

SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP., SAGINAW, MICH.

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Saginaw Steering Gear Division, General Motors Corporation
b/b Screw and Spline Operation, Dept. 3AM,
Saginaw, Michigan

Please send 1958 engineering data book on Saginaw b/b Screws and Splines, and standard assemblies price list, to:

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Announcing Webber

SQUARE

GAGE BLOCKS

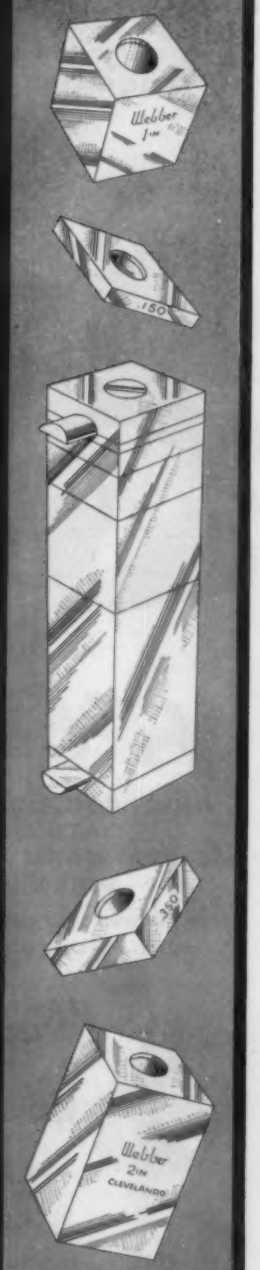
in Steel and Croblox

Webber Gage Company, ***pioneers in the development of Chrome Carbide Gage Blocks,*** proudly announce the availability of **SQUARE** Gage Blocks both in standard steel and Croblox (solid chrome carbide).

Catalog and prices available upon request.

Webber **GAGE COMPANY**
12901 Triskett Rd., Cleveland 11, Ohio

Set No. 88A w/accessories plus one pair .100 and one pair .050 Croblox wear blocks.



LARGEST EXCLUSIVE MANUFACTURERS OF PRECISION GAGE BLOCKS

They look like twins... but one is synchronous

Louis Allis "SYNCRO-*SPEDE*"* offers... for the first time... a synchronous motor in the same frame sizes as a standard induction motor

New from Louis Allis — *the most compact and efficient synchronous induction motor on the market* ... the revolutionary "Syncro-Spede." It's the *only* synchronous motor built in standard NEMA frames for comparable ratings in any enclosure.

The space-saving "Syncro-Spede" has no external excitation, wound rotating fields, collector rings or brushes—offers simplified control and low-cost operation. And it's virtually maintenance-free.

In performance, "Syncro-Spede" delivers and maintains exact synchronous speed within its rated capacity, regardless of load variations or voltage dips. When "Syncro-Spede" motors of several different ratings are powered by a single adjustable-frequency source, their acceleration, running speed, and deceleration can be synchronized.

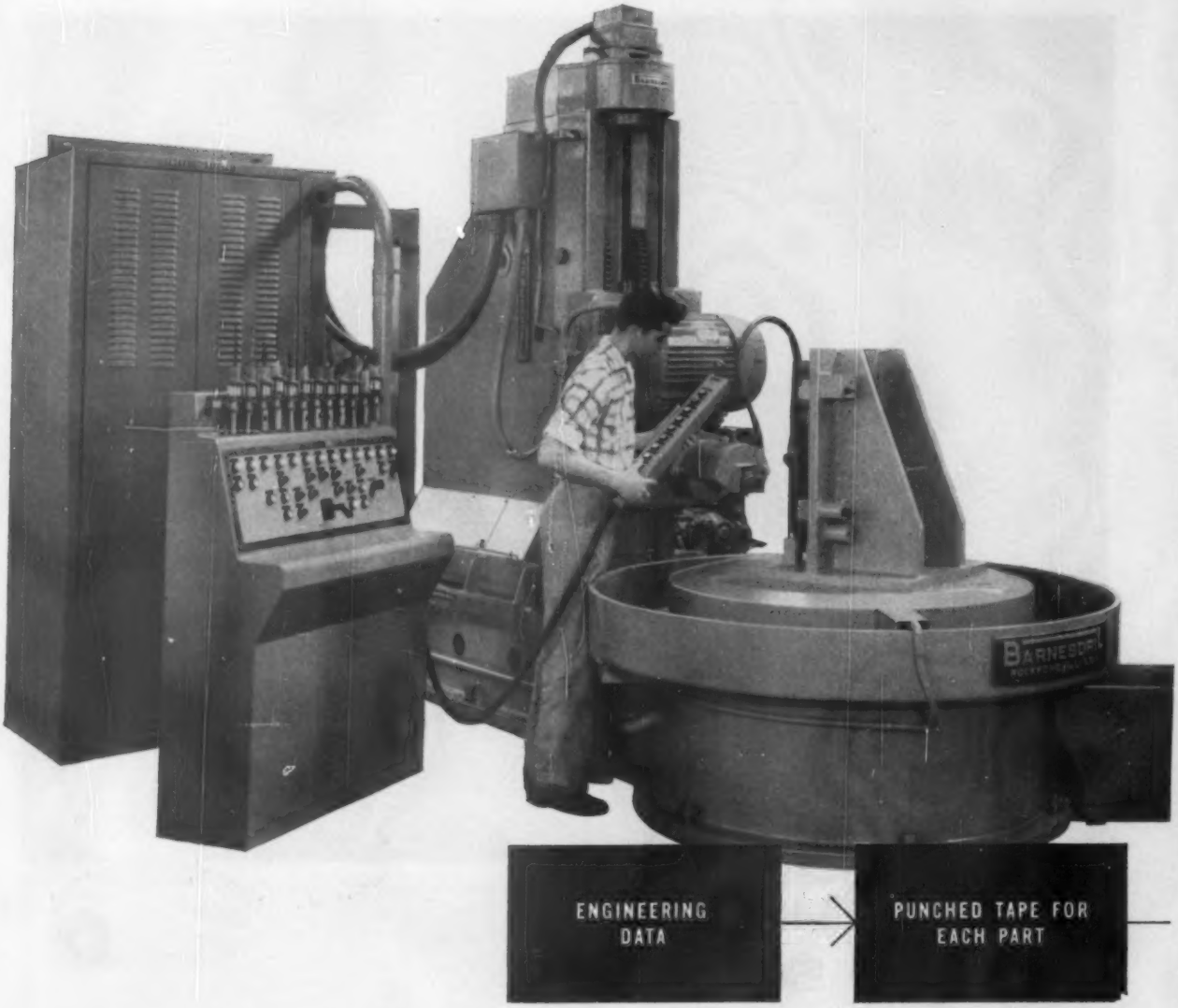
"Syncro-Spede" is the low-cost answer to such demanding synchronous applications as *precise adjustable-frequency multi-motor systems*... high-frequency generator drives and constant-speed conveyor drives . . . precision timing and metering devices . . . recording instrument drives . . . any system requiring constant speeds from no-load to full-load.

"Syncro-Spede" sizes range up to 100 hp. For information and expert application engineering assistance, contact your nearby Louis Allis District Office or write directly to The Louis Allis Company, 452 East Stewart Street, Milwaukee 1, Wisconsin.

*"Syncro-Spede" is a trademark of the Louis Allis Co.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES



specifications:

248 Operations—
drilling, spotfacing, chamfering

Capacity—
parts up to 36" O. D. x 30" long

Spindle Capacity—
drill ¼" to 1" in steel,
3" O.D. x No. 3 Morse Taper

Spindle Travel—
30", with max. speed of 60 ipm.

Spindle Head—
hydraulic cylinder actuated,
300 ipm. rapid approach,
speeds—as selected by tape
feeds—4-feed rates between 0.5 and 11 ipm.

Rotary Table—
40" O.D., 1½ HP motor

Tools—
13, quick-change type

new **BARNESDRIL** machine

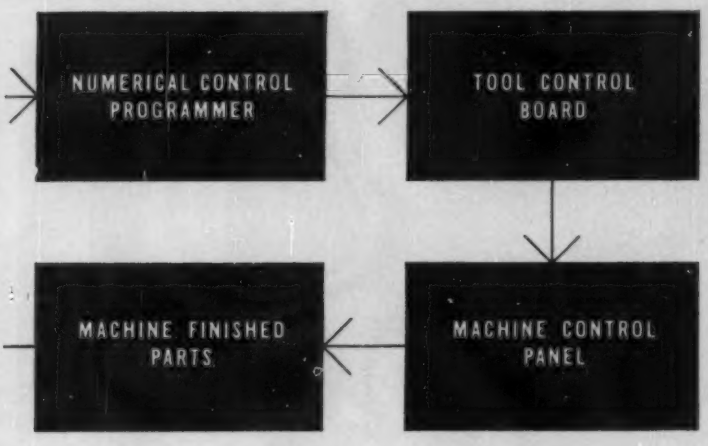
automatically programs 248 operations

on compressor housings

- **features numerical control by punched tape, unique tool control board**
- **reduces set-up, saves fixturing costs, assures accuracy**
- **solves high-volume, short-run production**

This new BarnesdriL programming machine automatically performs a preselected pattern of operations for machining gas turbine compressor housings, from information stored on standard, business-machine type, punched tape. The pattern is changed at will by substituting a different tape, and the pattern applies to single or multiple plane operations.

A specially designed tool control board integrates the machine programming with the proper sequence of cutting tools, so that the machine will not operate until the correct tool has been selected and placed in the machine, and all others returned after use to their proper places on the tool board. Tools are quick-change pre-set type, selected successively for drilling, boring, reaming, tapping, spotfacing and chamfering.



Information fed back from the machine's movements by means of selsyn motors maintains a constant check on the accuracy of positioning. In actual operation the machine cycles constantly within .003" for true positioning tolerance. Repeatability accuracy is within .001".

With program-type machining, BarnesdriL engineers provide automatically-selected spindle speeds in sequence, according to the best machining practice for the particular operation and kind of material. Feed rates are also programmed to meet the requirements of the part design and machining operation.

Flexibility in type, number and position of operations is obtained by substitution of separate tapes for individual parts to be machined. As a result substantial savings are realized in set-up time and fixturing costs. These are important advantages in high-output, short-run production. Also, with the flexibility inherent in program-machining, the need is eliminated for stock-piling parts.

your inquiries are invited!

BarnesdriL engineers invite your questions and inquiries in connection with production savings involved in program machining for high-output, short-run parts. Send parts or drawings for estimates, or request an engineer to call and discuss these problems in your plant!

50th year

BARNES DRILL CO.

830 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

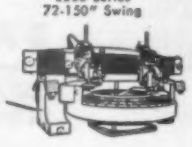
Frauenthal *1200 Series*

☆ single spindle vertical precision grinders

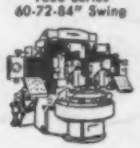
Bird's-eye view of a new Frauenthal 1200 Series (belt-driven) single spindle, vertical precision grinder. These versatile machines are designed to meet a broad range of present requirements . . . are readily adaptable to future requirements.

F **PRECISION PRODUCTION VERSATILITY**

2200 Series
72-150" Swing



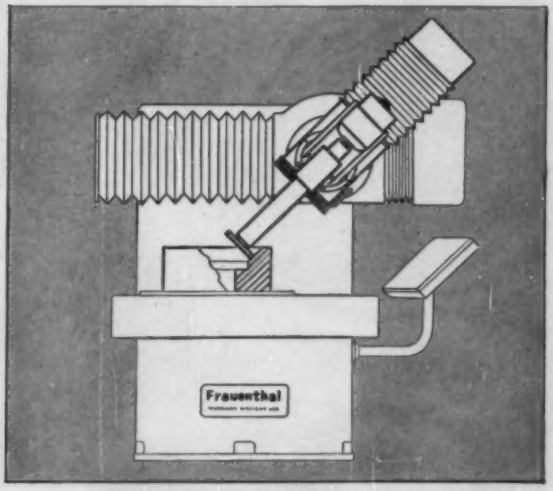
1800 Series
60-72-84" Swing



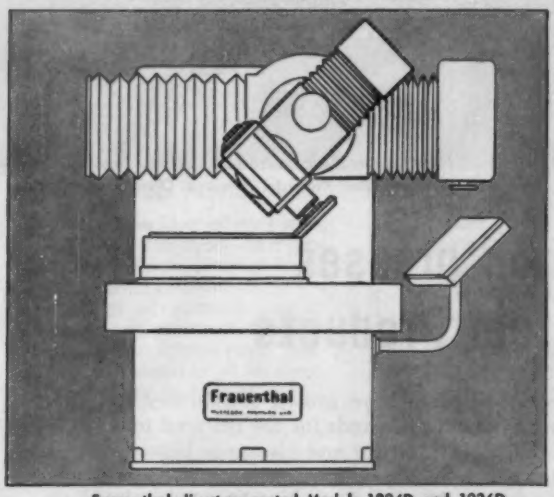
3100 Series
60-72-84" Swing

creatively engineered

...accuracy to .000100" at spindle nose



Frauenthal belt-driven Model 1224B and 1236B single spindle, vertical precision grinders have an extreme angle setting of compound at 45°. Versatility such as this permits angle, internal, external and face grinding to millionths-of-an-inch related tolerances.



Frauenthal direct-connected Models 1224D and 1236D are ideal for rotary surface grinding, O.D. surface and angular approach grinding operations. A variety of grinding spindle positions is possible with this head arrangement.

assures uniform, super-precision part after part!

Super-precision is the natural result of overall Frauenthal single spindle, vertical precision grinder rigidity; of proven performance . . . and *continuous* application of advanced grinding techniques.

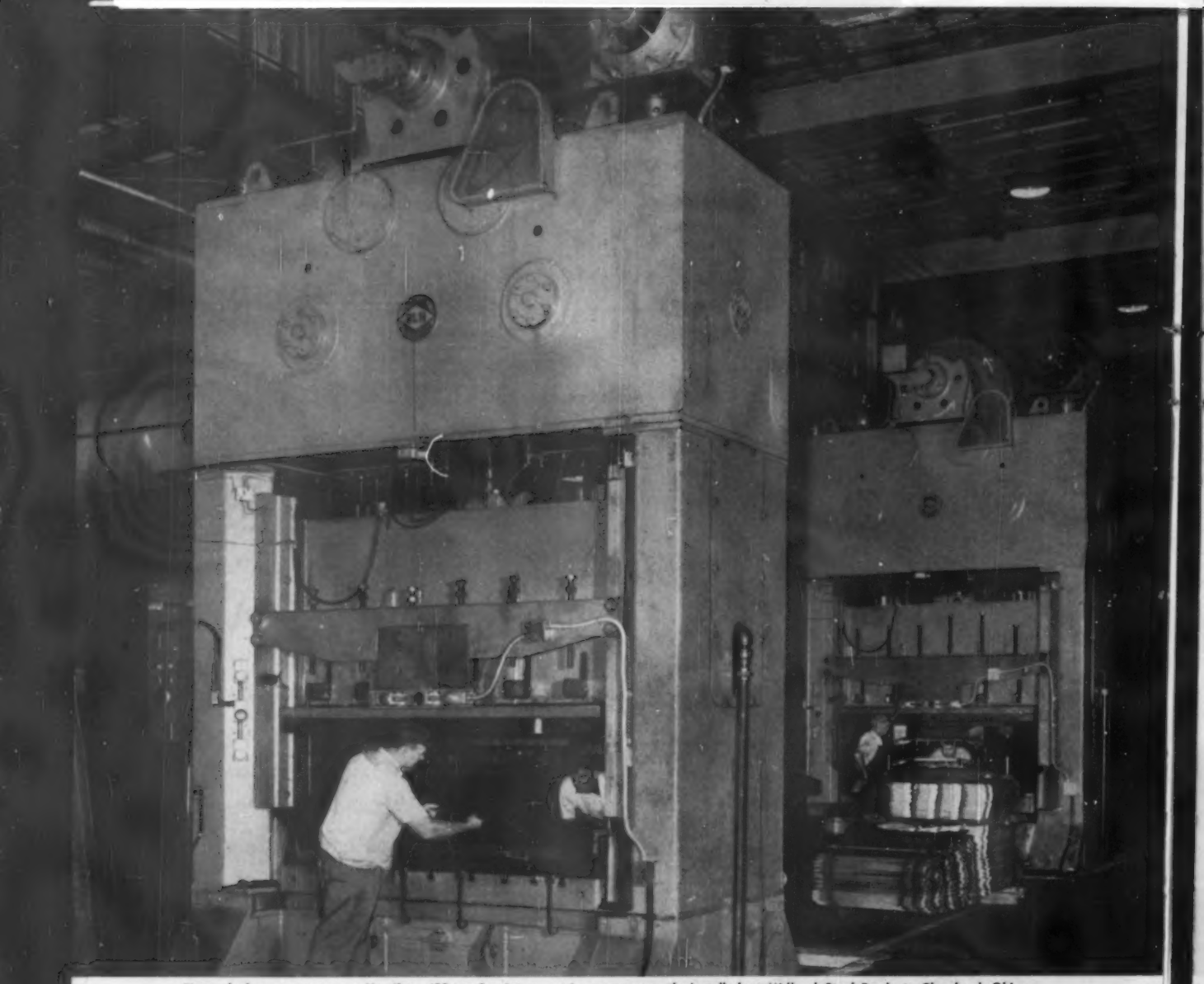
These new Frauenthal 1200 Series machines are available with choice of belt-driven or direct-connected grinding spindles. Machines with either spindle arrangement are offered with 24" dia. tables x 36" swing and 36" dia. tables x 48" swing capacities inside splash guards. Additional swing can be obtained by removing guards.

Write for free Bulletin

1200 Series 36-48" Swing

Special Grinding Machines using standard Slide Units

Frauenthal Division
THE KAYDON ENGINEERING CORP.
MUSKEGON, MICHIGAN, U. S. A.



Pictured above are two new Hamilton 400-ton 2-point eccentric presses recently installed at Midland Steel Products, Cleveland, Ohio.

Versatility of Hamilton presses praised by Midland Steel Products

Four new Hamilton-built production presses were recently installed in the frame plant of Midland Steel Products, Cleveland, Ohio. Assistant to Plant Engineer Haldon R. Falquet describes these presses as "extremely versatile and flexible." Currently they are producing parts for 1958 model cars, but they are designed to accommodate the still larger parts now on the drawing boards for 1959 and 1960 models.

Mr. Falquet reports that in his experience there are numerous applications where Hamilton Presses "most often have proved satisfactory in meeting Midland's demands for the required tonnage, shut height, stroke and clearance between columns which enable us to meet our customers' specifications." One of the many Hamiltons in service at Midland is a 4000-ton press—the largest of its kind in the country—and turning out huge side rails for trucks and buses in a single hit.

Let us discuss your press problems with you. Perhaps our know-how in press building can save you money or improve your product—or both!

Hamilton Division Hamilton, Ohio

BALDWIN · LIMA · HAMILTON

Diesel engines • Mechanical and hydraulic presses • Can making machinery • Machine tools

R B&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Fastener coatings

Salt spray testing of various metallic coatings used on fasteners doesn't always give a true picture. In actual service, accelerated test results are not always borne out.

Reason: The tests favor the coatings which can endure continuous moisture and salt atmospheres, whereas some do better under the normal intermittent dry and wet conditions of weathering.

Experience has developed a "scale" of suitability of various coatings for fastener protection.

FOR RUST PROTECTION

Hot galvanizing offers greatest endurance under most conditions. It falls short on highly stressed fasteners.

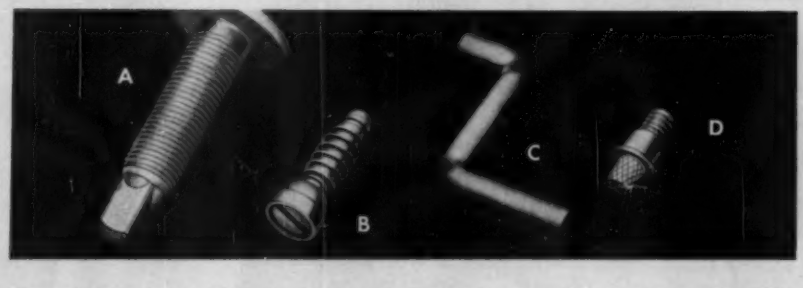
Electrodeposited zinc is next most practical – providing good appearance, controlled tolerance at threads, and ability to take high bolt tensions.

Cadmium plate stands out where salt atmospheres predominate. Not suitable for contact with edibles, it is ruled out for many appliances.

For general applications, the rust prevention of black oxide coatings proves satisfactory. Phosphate coatings, too, offer some degree of protection, but not under severe conditions.

Chromium, plated over copper, should be considered more for its appearance on fasteners rather than protection.

Cold heading creates quality parts the low cost way



No value analysis of product components is really complete without exploring what cold heading machines can do to cut costs. Some examples:

A. ELIMINATE EXTRA OPERATIONS. Leveling screw, formerly made by riveting flat disc to set screw, now emerges as a stronger, single piece from a cold header.

B. ONE PIECE BETTER THAN TWO. Cold headed hose clamp screw has integral flange which, after head is slotted, is forced up to form screwdriver shield. Before, piece was in two parts . . . with screw made on screw machine, and the shield a stamping fitted around head during assembly.

C. FASTER THAN FORGING. Shifter lever is bent into double "L" automatically in bolt header . . . replacing 2-stage forging operation. The header does it at high speed from continuous rod.

D. METAL *FLOWS* TO SHAPE—NO WASTE. No longer cut on screw machine, insert screw for plastic parts costs 40% less. Cold header uses just the amount of metal required. The threading and knurling, too, are done automatically at high speed.

Metal forced to cold flow into shape results not only in savings but also in stronger parts. With uncut flow lines, the piece is better able to withstand stress concentrations.

For an expert opinion on parts you now use, check with Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

12-point fasteners cut wrench clearance space

Double hex RB&W bolts and nuts measure smaller across their points than single hex fasteners. Used with an *external* socket wrench, they permit optimum driving torque to be applied.

Thus, while permitting design of more compact assemblies, these fasteners also assure proper preloading for stronger connections.

Available with plain flange, or SPIN-LOCK design which incorporates teeth that embed upon tightening and resist loosening under vibration or temperature changes.

Don Oberg tells why the Moore Jig Grinder is an absolute must in any good die shop

by **DON E. OBERG**
General Manager
Oberg Manufacturing Co., Inc.
Tarentum, Pa.
Largest Manufacturer of
Carbide Dies

"One of the most important features of an Oberg-built die is guaranteed complete and positive interchangeability of parts throughout the life of the die. *This feature would be practically impossible without the application of Moore Jig Grinders.*

"With Moore Jig Grinders we can accurately locate holes with relation to each other as well as size holes to extreme accuracies. We can efficiently grind contours on carbide die sections which would be impractical by almost any other method. Back taper on contoured carbide die sections and piercing holes can be readily generated on Moore Jig Grinders.

"We feel it would be *practically impossible* to produce the high precision carbide dies required by industry today without the Moore Jig Grinder. *In our opinion it is an absolute must in any better-than-average die shop.*"

As Mr. Oberg points out, the Moore Jig Grinder has no equal on many essential toolroom operations. If you would like a bulletin describing some of the features that make this machine so outstanding, just drop us a line.

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Connecticut

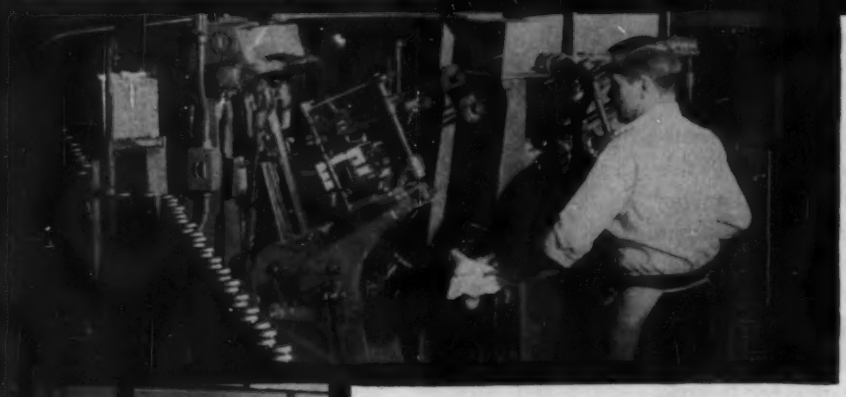
"The things we like best about our four Moore Jig Grinders are the sturdiness and dependable long-life accuracy built into them. Ours are used ten hours or more every day. Even with this high activity, we have found no apparent inaccuracies from our oldest to our newest machine."

HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. $5 in U. S. A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

People buy Scott Wipers for many reasons:



Mr. R. G. Mathi, of the Process Control Department, Anheuser-Busch, says: "We use Scott Wipers for keeping transfer tables clean, wiping excess glue at our label machines, wiping safety glass partitions, preventing moisture accumulation on machines and other equipment, cleaning dismantled equipment and parts, and of course for personal use—because they're absolutely sanitary."

ANHEUSER-BUSCH says: "Scott Wipers help us maintain a clean, sanitary plant!"

Famous Budweiser, Busch Bavarian and Michelob Beers are bottled, canned, barrelled and packaged under the most rigid standards of quality control. Early in 1956, Anheuser-Busch, Inc., St. Louis, put in Scott Wipers as a "housekeeping aid," with great success. Disposable 2-ply paper Scott Wipers are soft, highly absorbent, lint-free and uniform in size . . . make housekeeping easier. Employees like their quick availability in individual boxes at each work station. Scott Wipers are always fresh and sanitary out of the box! And being disposable, Scott Wipers eliminate special handling.

SCOTT PAPER

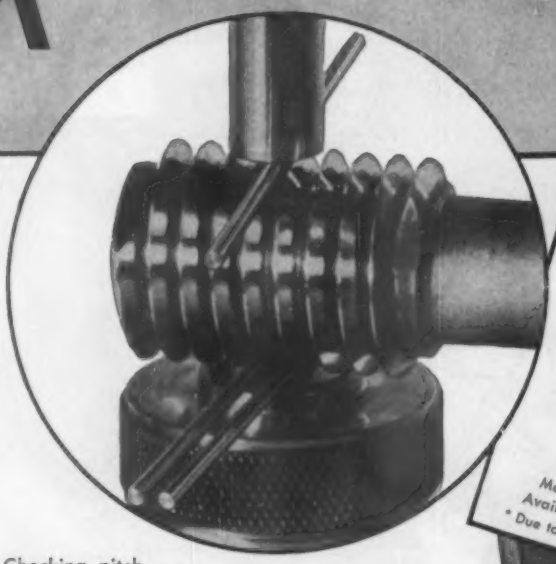
For the complete Anheuser-Busch case history—facts and figures—find your local Scott distributor in the Yellow Pages under "Paper Towels" and call him! Or write: Scott Paper Company, Dept. AM-712, Chester, Pa.

Maker of the famous Scott paper products you use in your home. See "Father Knows Best" and "The Gisele MacKenzie Show" on NBC-TV.

SIMPLIFIED TOOLING CUTS COST OF MACHINING

VK THREAD MEASURING WIRES

▼ Standard equipment everywhere



Checking pitch diameter of thread gage by three wire method on VK Light Wave Micrometer.

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For all standard Unified and American Threads 2 to 80 P

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Available from stock at no increase in price.

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Every set of VK Standard Thread Measuring Wires, in addition to being within .000020" of best size, is now calibrated and furnished with matching constant. In many cases this will result in considerably more accurate pitch diameter measurements. These wires are the accepted standard equipment for making pitch diameter measurements of taps, thread gages, precision threaded parts, hobs, worms, splines and gears. For the great majority of 60° Unified and American threads, the Set No. 20 H.S. pictured at the right will fill your needs. Similar sets to ± .000020" accuracy are available for single-start threads of other pressure angles. For threads which have a lead angle greater than five degrees, or multiple-start threads and worms, special size wires should be used.

Set No. 20 H.S. Thread Measuring Wires

Set No. 20 H.S. Thread Measuring Wires is a plant necessity for maintaining taps and thread gages within their limits for wear and for proving the pitch diameter of screws and threaded parts.

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Special wires from .002" to 2.000" diameter are made to any tolerance required.

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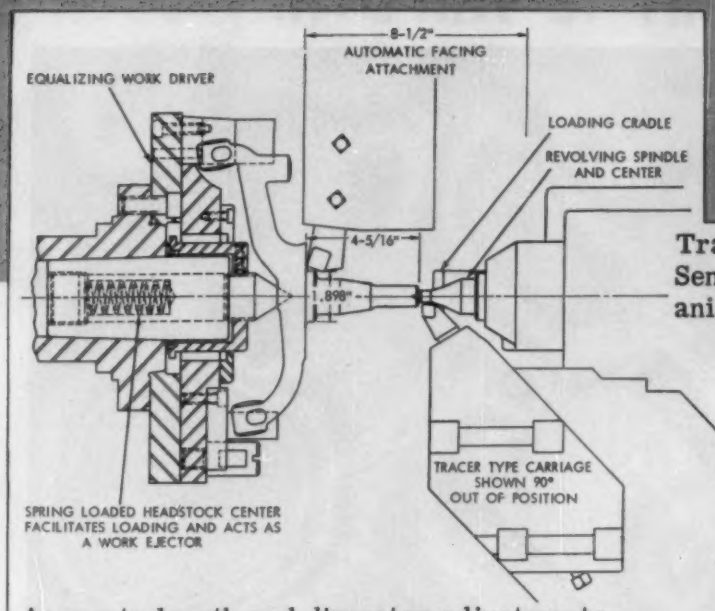
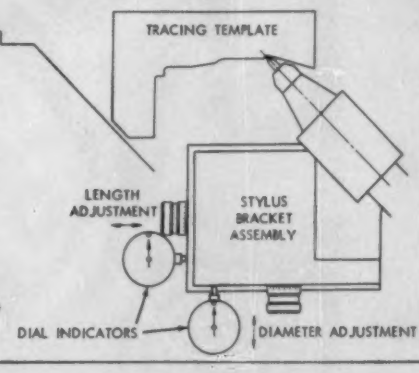
See "Father Knows Best" and "The Gisele MacKenzie Show" on NBC-TV.

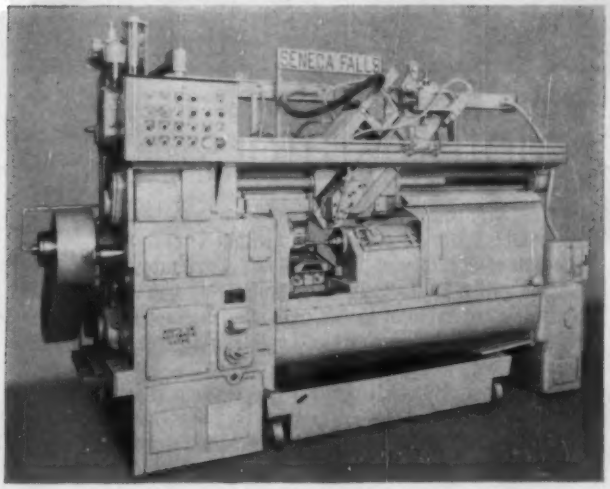
SIMPLIFIED TOOLING CUTS COST OF MACHINING STEERING KNUCKLES ON SENECA FALLS Automatic TRACER LATHE



Tracer slide operated by Seneca Falls Electro Mechanical Control System.



Accurate length and diameter adjustments are facilitated by two dial gages built into the stylus setting slides.



SENECA FALLS MODEL LQ Automatic TRACER LATHE

Two cutting tools generate the form required. The rear tool removes excess material from the flange face in a coarse-feed, roughing cut. The tracer-controlled tool finish turns both the stem end and flange face. The two carbide inserts may be indexed or rotated to provide new cutting points in a matter of seconds. Tool setting is practically eliminated!

Work handling time and operator fatigue also have been reduced. The operator places the work piece on the spring-loaded head center with the stem end resting on a Vee-shaped loading cradle at the tailstock. The piece is then rotated clockwise until the arm is in contact with a spring stop on the driver. An air valve operating the tailstock quill is then opened, pushing the piece and the head center back against a solid stop and into driving position.

Spindle speed is electronically controlled to provide a constant cutting speed over the stem diameters and the face of the flange—thus assuring maximum production with optimum tool life and finish.

Get the facts on this newest Seneca Falls Lathe.

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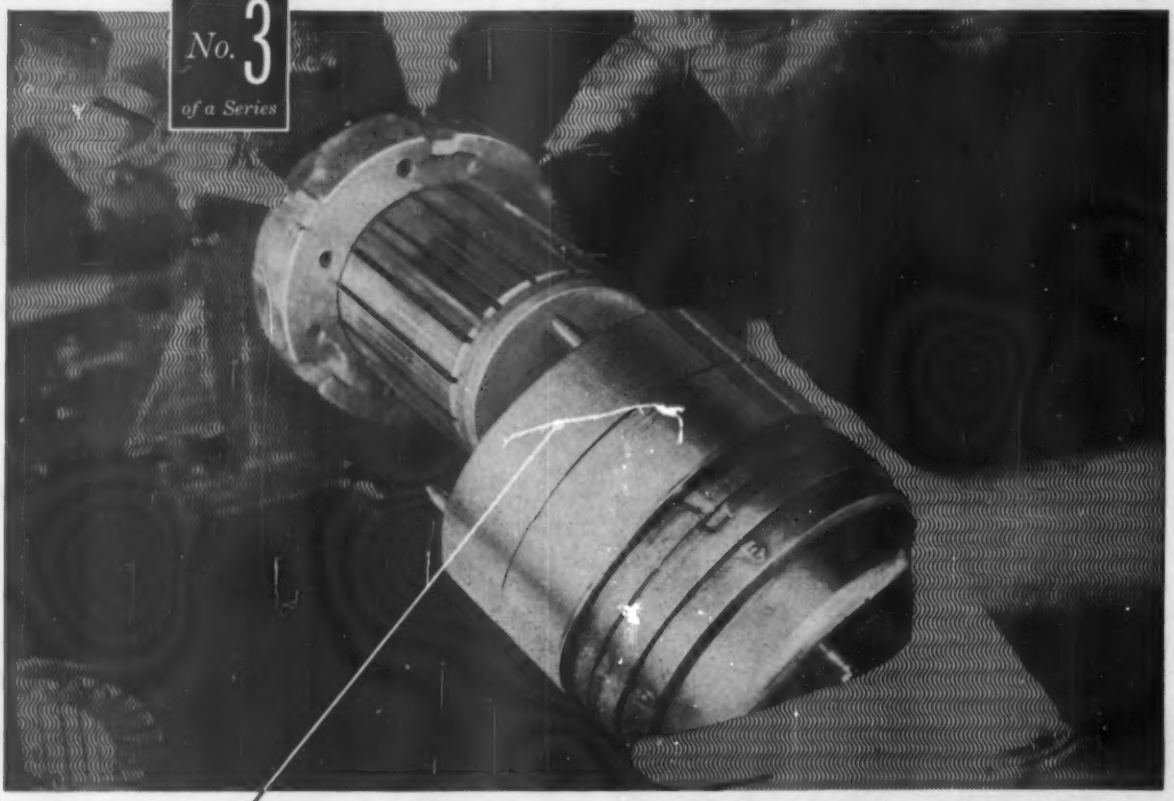
Erickson Precision Expanding Mandrels Solve Assembly Problems

No. 3 of a Series



Photos: Courtesy The Emerson Electric Mfg. Co., St. Louis

e.g. electric motor stators

Emerson Electric, big-name electrical manufacturer, assembles stator laminations the modern way—with Erickson Mandrels. Gone are the old-fashioned arbor assembly methods that require a large tolerance between laminations and arbor . . . that lead to eccentricity of stator bore and to additional finishing operations on the OD.

Emerson Electric works "from the inside out" with Erickson Precision Expanding Mandrels. Laminations are placed on a fixture and the fixture slipped over the expanding mandrel. Laminations are then welded together with two passes through a three-torch head.

Result? Stators are concentric within Erickson's guaranteed accuracy of five "tenths." And Emerson Electric gets a better motor with uniform air gap . . . that produces uniform torque and rated horsepower . . . that creates minimum electrical interference . . . and that lasts longer.

If this cost-cutting case history triggers your imagination, contact the nearest Erickson representative. He'll be pleased to demonstrate how Erickson Precision Expanding Mandrels can cut your assembly costs.

AA-4138

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Special Holding Fixtures

Bothered by a tough holding problem? Then let us show you how Erickson mandrels speed production, lower grinding or inspection costs. Write for Catalog K.

ID of stator assembly (lower left) requires no finishing operation after welding.

IF YOU HAVE ANY OF THESE PROBLEMS...

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Obtaining Close "No-Taper" Tolerances

Boring at High Speeds and Feeds

Controlling Drag-Out Marks

HERE'S YOUR ANSWER...

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Whenever a boring job requires unusual stiffness—and whenever the restrictions on the ratio of diameter to length make it impossible to get this stiffness by "beefing up" a steel bar—you'll find your answer in this new Kennametal Tool.

Because Kennametal has three times the YME of steel, the Kennametal bar body provides the greater stiffness needed to prevent chatter, taper or weaving and resulting spoilage due to drag-out scoring. Furthermore, the "Torque Tube" principle of design concentrates the Kennametal in the area of greatest stress, obtaining maximum benefits with minimum material.

Users have already reported the successful machining of jobs which were impossible to handle before . . . and greatly improved output and quality on jobs that had to be "babied" when ordinary boring bars were used.

In addition, Kennametal encased boring bars permit the use of extremely hard grades of Kennametal in cutting high-tensile steels. The stiffness of the bars prevents the vibration that causes chipping and chatter-damage to the tool, and often ruins the work. Kendex throw-away type inserts permit quick indexing of new cutting edges without affecting the bar setting, and eliminate costly regrinding.

These Kennametal Encased Kendex Boring Bars are available with square or triangular inserts in a number of types and sizes. Even round inserts can be used because of the rigidity of the bar. Special designs for unusual applications can be engineered for you. Ask your Kennametal Tool Engineer for details, or write, outlining your special requirements to: KENNAMETAL INC., Latrobe, Pennsylvania.

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C-3088

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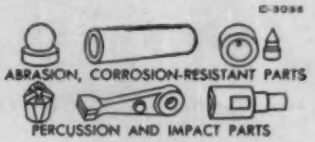

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Hammers forge some pieces more efficiently than presses; presses work some forgings better than hammers. What is a forging man to do? Easy! Talk with the firm that makes the best in both hammers and presses . . . talk with Erie Foundry Company. We will help you with expert specific advice on the right machine for your forging requirements.

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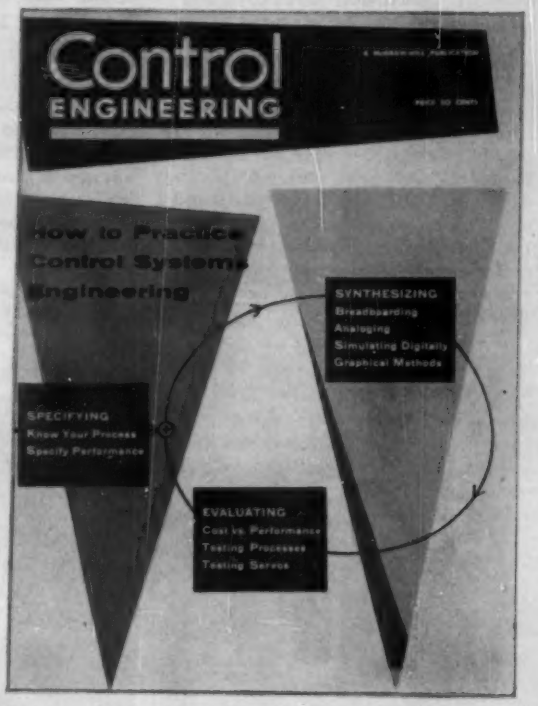

Read how Point-to-Point Positioning Systems *automatically* control precise movement in machine tool operation—in the January and February 1958 issues of CONTROL ENGINEERING.

This timely two-part report, *Point-to-Point Numerical Positioning Systems,* will describe about 30 practical systems, including —

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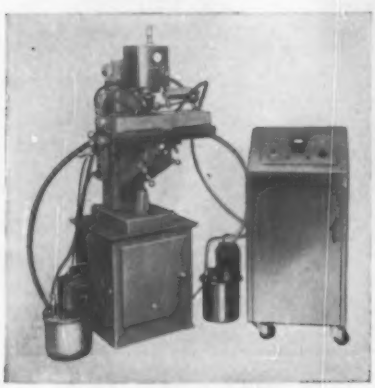
MACHINE TOOL

Facts about Impact Grinding

HOW ULTRASONIC MACHINING REDUCES COSTS — SPEEDS PRODUCTION

IMPACT GRINDING OFFERS NEW FREEDOM OF DESIGN

Abrasive specialists, design engineers, production men now have remarkable new freedom of design with the Raytheon Impact Grinder. Since it is possible to reproduce an exact counterpart of the tool in the work piece, intricate shapes can be produced with speed and precision. Slicing, drilling, trepanning, shaping and contouring can be performed with extreme accuracy, since the work is not subject to heating or distortion.



Raytheon Impact Grinder

HOW IT WORKS

In impact grinding, the tool is made to vibrate at 25,000 cycles per second by ultrasonic power. Abrasive particles suspended in water are introduced between the tool and the work piece. Millions of these particles are driven with accelerations up to 150,000 times their own weight and grind an exact counterpart of the tool in the work.

Carbide dies formed by impact grinding

IDEAL FOR HARD OR BRITTLE MATERIALS

Hardened steels, carbides and ceramics are readily machined with the Impact Grinder. A wide variety of softer materials can also be processed. Intricate dies can be formed in carbide with great saving of time and increase in die strength and life.

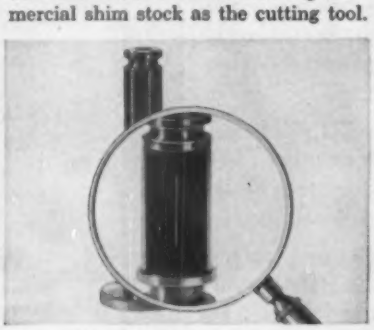
Among the materials successfully machined with the Raytheon Impact Grinder are:

Ceramics	**Ferrite**
Glass	**Hardened Steel**
Ruby	**Titanium Carbide**
Semi-conductors	**Tungsten Carbide**

Long-life heading and stamping dies of tungsten carbide

SPEEDS PRODUCTION

One instance of the time-saving achieved with the Impact Grinder is this .004" precision slot in a stainless steel hydraulic mechanism. By conventional methods, cutting this slot was so difficult and time-consuming that one unit per day was considered a fortunate production rate. The Impact Grinder cuts this slot in 20 minutes using commercial shim stock as the cutting tool.



.004" precision slot in valve mechanism

REDUCES COSTS

A typical example is this carbide knurling die which formerly cost $265 each when produced by conventional methods. Using the Impact Grinder to cut the serrated portion only, reduces the cost by $200.

Carbide knurling die

EXCELLENT FINISH

Because the Raytheon Impact Grinder produces finishes to 8 microinches, additional finishing after impact grinding is reduced to a minimum. Important cost and time savings result.

OTHER IMPORTANT ADVANTAGES OF IMPACT GRINDING

- No heating of material or distortion of grain structure
- Requires only a semi-skilled operator
- Simple, inexpensive tooling

APPLICATION ENGINEERING SERVICE FOR YOUR PROBLEMS

Find out how impact grinding can solve your metalworking problems. Raytheon's Application Engineering Service will be happy to assist you at no cost or obligation. For complete information and catalog, please write Dept. 6120P.

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Commercial Equipment Division, Waltham 54, Mass.

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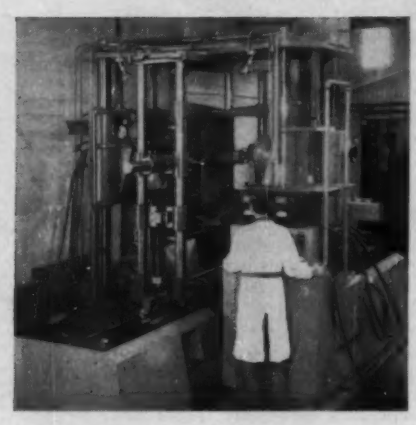
O-KNI-CO

MACHINE TOOL news

PRODUCTION FACTS THAT INCREASE YOUR PROFITS

PUBLISHED BY THE OHIO KNIFE CO., CINCINNATI, OHIO

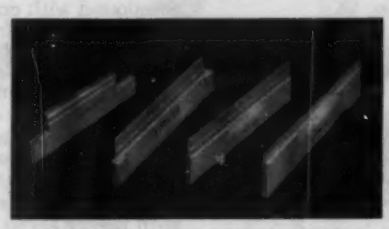
New drilling machine produces multiple hole patterns with absolute accuracy



Built by Walter P. Hill, Inc., Detroit, Mich., this opposed-spindle drilling machine has a flexible automatic system for positioning heads and table for producing hole patterns. To achieve the high degree of accuracy necessary, all components must continually operate on close tolerance. The ways, being exposed, are subjected to brutal treatment (falling steel chips, operator walking and standing on them) and consequently must have high wear resistant qualities. O-KNI-CO processed hardened ways were selected to run against O-KNI-CO processed aluminum bronze wear plates. These ways are so hard (Rockwell 66 C) as to practically eliminate galling or scoring.

Are you using flame hardened ways on your equipment?

If you are, the chances for scoring, galling and general wear are increased due to the variation in depth and quality of the hardening characteristic of this type of heat-treating. Since The Ohio Knife Co. first offered O-KNI-CO processed hardened ways some years ago, O-KNI-CO ways have become first choice with builders of quality machine tools. Special analysis tool steel of any thickness is bonded to a soft, tough, easily machinable steel. This produces a way that will not warp or bow. Special O-KNI-CO hardening process (65-66 Rockwell C) to the full depth of the tool steel, along the entire length of the way, develops fantastic wear-resistant qualities. The result is continuing accuracy of the machine under severest work loads.

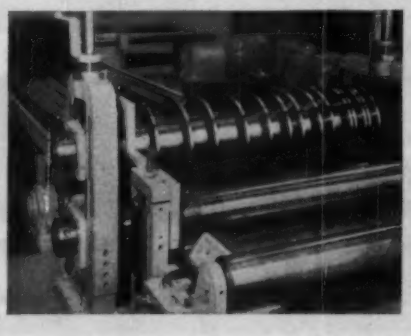


O-KNI-CO blades now standard equipment on most centerless grinders

Phenomenally long life of Ohio Knife Co. centerless work blades and guides makes them No. 1 on the blade parade. Extreme hardness, high finish, close tolerance, keeps them in operation on high production schedules. Made of tungsten carbide, high speed steel, cast alloys or iron. Non-metallic tips available. Special contours, angles or shapes made to suit requirements.

The Yoder Co., Cleveland, Ohio watch slitting costs decrease

Continuous slitting operations with an absolute minimum of downtime for regrinding slitters is a major factor. Slitters made by The Ohio Knife Co. are widely used in this operation. Made to exacting metallurgical specifications, special heat-treating, careful grinding and finishing to tolerances of plus or minus .00025 or more are reasons why they are selected by The Yoder Co.



O-KNI-CO Composite Die Sections on blank and pierce die for 4' x 6' refrigerator at Ready Machine Tool & Die Co., Inc., Connersville, Ind.

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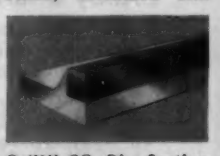
You buy them at a price *far below* what it's costing you to make them yourself. You receive them with cutting or forming edge already hardened, machined and ground. The soft steel backing, to which our specially hardened tool steel is clad, can be drilled quickly and economically for dowel and screw holes. Adjustments for wear are equally simple. Hundreds of companies who have switched to OK Composite Die Sections for Cutting, Trimming and Forming Dies, report great time and money savings, plus longer die life. New bulletin on OK Composite Die Sections and Clad Aluminum Bronze Wear Plates available.



O-KNI-CO Die Section showing tool steel bonded to mild steel backing

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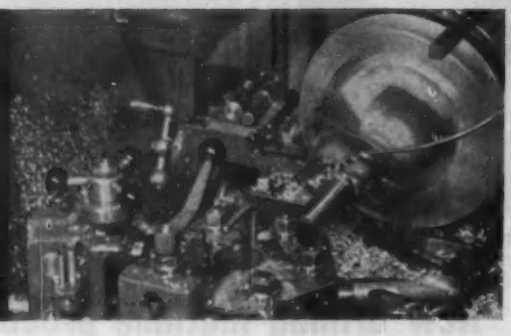


Aluminum alloys are recognized throughout the machining industry as having inherently good machinability. They cut easily at high speeds, require less machine energy, and rapidly conduct heat away from the tool point.

Points to Remember

There are five fundamental points to remember when machining aluminum:

1. *Adjust machining practice to take advantage of aluminum's excellent machinability.*
2. *Use machines that operate smoothly and efficiently at high speeds.*
3. *Adjust rake angles to alloys, use keen cutting edges, smooth tool surfaces and ample chip clearances. Support tool near cutting edge.*
4. *For roughing, use moderate to high speeds with moderate to heavy cuts and feeds. Increase speeds and diminish cuts and feeds for finishing.*
5. *Use the proper lubricant or coolant and apply copiously.*

Alloy Characteristics

Most wrought aluminum alloys have excellent machining characteristics and are well suited to the production of intricate parts and screw machine work.

Casting alloys with copper, magnesium or zinc as a principal alloying element are easily machined. Very high silicon alloys cut freely, but tend to be abrasive. Therefore, carbide-tipped tools are recommended.

Common (non-heat-treatable) alloys tend to give continuous turnings that must be directed away with generous side and top rake angles to avoid surface scratching. They cut easily and tool pressure should be light. Machinability is improved by cold working to harder tempers.

Strong (heat-treatable) alloys can be machined to a fine finish with a good coolant-lubricant recommended for most operations. Free machining alloys have chip breaker constituents.

2011 is a high strength, free-machining alloy which can be machined at high speeds and feeds with a low rate of tool wear. It is excellent for screw machine operations, and is also recommended for general machine work requiring a free cutting alloy.

Tool Design

In general, tool geometry is determined by alloy hardness and temper.

Smallest rake angles can be used for free-machining alloys and roughing cuts. For example, 2011-T3 usually requires a rake of 0°-3°.

Larger rake angles are required for optimum machinability of soft alloys. Wrought alloys like 6061-T6 usually need 10°-15°; casting alloys like 43, 195-T6 and 380 frequently use a rake of 15° or more.

Use the *smallest* cutting angle compatible with alloy hardness and abrasive quality to reduce tool pressure and improve finish. In most cases, clearance angles of 6°-10° are suitable.

Lubricants, Coolants, Cutting Compounds

It is good practice to use coolants and lubricants generously for longer tool life and better finishes. However, for light cuts, many aluminum alloys can be machined dry.

A combination coolant-cutting compound is a "must" for clean surfaces and close tolerances in finish machining. Remember that aluminum alloys expand from heat more rapidly than steel or brass. This makes coolants especially important.

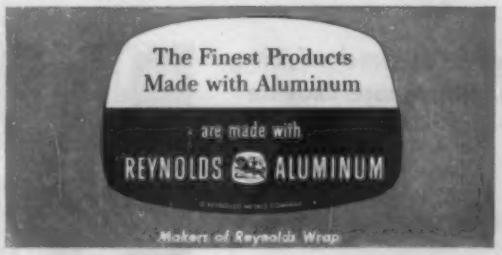
With slow surface speeds and heavy cuts, use a compound with good lubricating properties. Cooling is a secondary consideration here. But on finishing work, where surface speeds are high and cuts shallow, cooling is vital, and lubricating not quite as important.

Use a cutting compound with moderate viscosity and good lubricating properties where cutting speeds are low and chips are heavy, where chip flow is restricted.

Use lower viscosity, coolant type compounds with higher speed operations and shallow cuts.

A complete handbook, with charts, tables and discussions of all the various machining operations with aluminum is available from Reynolds. Write today for "Aluminum Machining." Single copies available free when requested on business letterhead. And you can get expert personal assistance in any phase of aluminum production from your nearby Reynolds office, listed under "aluminum" in your phone book. Or write Reynolds Metals Company, P.O. Box 1800-JJ, Louisville 1, Ky.

REYNOLDS ALUMINUM



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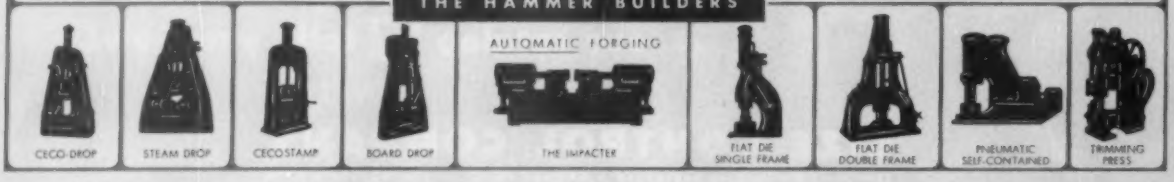


Resistance Welding Jet Engine Parts

SCIAKY

HELPS PUT PROFIT INTO MANUFACTURING

Heintz Achieves Volume Production with New Sciaky Counter Control Welders

In fabricating and job shops, where a wide variety of assemblies must be welded to rigid specifications every day, Sciaky resistance welding helps keep production schedules *on schedule*.

The Jet Engine Division of the Heintz Division, Kelsey-Hayes Company, a large Philadelphia contract fabricator, manufactures original and replacement parts for the aircraft industry. This means their production must meet exacting jet engine specifications.

New Sciaky Counter Control

To help meet these requirements, Heintz now uses Sciaky Patented Three-Phase Resistance Welders with the new Predetermined Electronic Counter Control. This new unit provides precise control of all welder functions for absolute production consistency. All control settings are realized with extreme accuracy, and are readily reproduced at any time to duplicate previous production runs. The machine cannot deviate from its setting.

Fig. 2 Seam welding stainless to stainless on Pratt & Whitney Aircraft J-57 jet engine transition duct assembly. Note simple fixture used.

Fig. 1 Seam welding Nimonic to Nimonic on Pratt & Whitney Aircraft J-57 afterburner diffuser section.

The Sciaky Predetermined Electronic Counter Weld Control is the only control of this type that has been proved in service, and the first unit of this kind has now been in use nearly two years.

How It Works

The Sciaky Predetermined Electronic Counter Control counts the cycles of power line frequency which is governed by the U.S. Naval Observatory. In predetermined absolute numbers, cycles and impulses are simply counted by a Dekatron tube to control the duration of the various welder functions. The absolute consistency of the control eliminates the need for time-consuming periodical check-out or calibration. Plug-in feature permits easy unit replacement, or addition of other control functions if required.

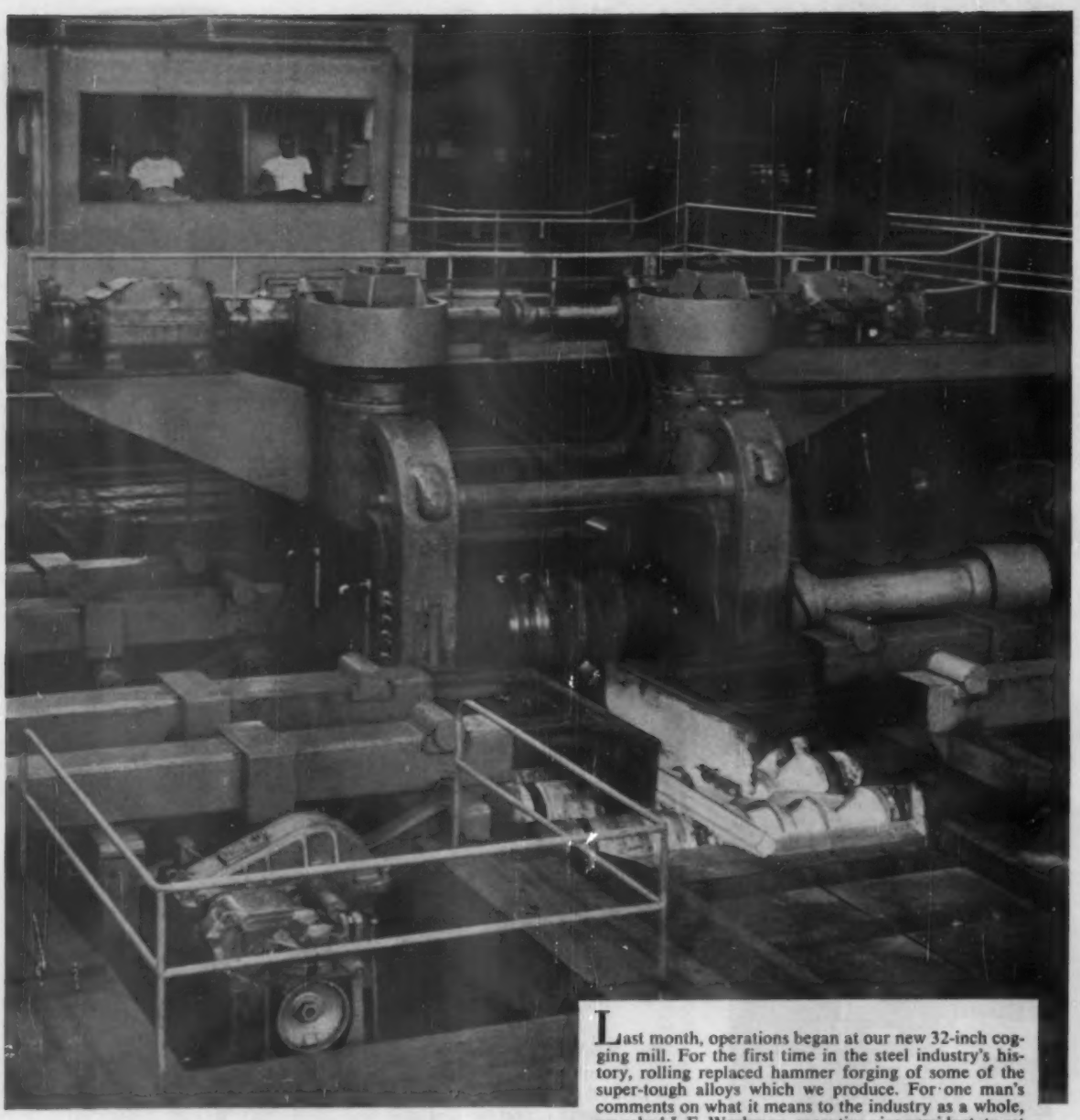
Operations Performed

Photos show typical Sciaky resistance welding applications on jet engine parts—Afterburners, Screech Screens, Engine Duct Assemblies, etc. Materials welded include Nickel Alloy, Nimonic and Stainless Steel.

Information Available

Case histories outlining the successful use of Sciaky Resistance Welding Techniques on jet engine components are available on request. Specific recommendations will be furnished on receipt of an outline of your requirements.

Write today, mentioning the information you would like to receive. There is no obligation. Sciaky Bros., Inc., 4933 W. 67th St., Chicago 38, Ill. POrtsmouth 7-5600. 62-C



"...could lead to significant industry increases..."

Last month, operations began at our new 32-inch cogging mill. For the first time in the steel industry's history, rolling replaced hammer forging of some of the super-tough alloys which we produce. For one man's comments on what it means to the industry as a whole, we asked J. E. Workman, executive vice president, to set down his thoughts.

"Naturally," says Mr. Workman, "we're proud of this accomplishment. But more important than that, we feel it could lead to significant industry increases in the production of vital highspeed and superalloy steels. For what we have learned can conceivably be used by many other companies.

"Just as important, for our customers and friends, is this point: the new mill reflects the everyday effort of this company to produce a better, more predictable product. There are other results of our research and development which don't make the headlines – but all make for better service and better products."

We're preparing a little booklet which tells more about the new mill. If you'd like to receive a copy of it when ready, please write us. Address Department A.

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MULTIPRESS boosts quality in rifle grenade production at SMP COMPANY

The M-31, new Army rifle grenade produced by the SMP Company of Portland, Oregon, gets a big assist from Denison's hydraulic Multipress.

Seventeen inches over-all, the grenade consists of nose, body assembly, and fin or stabilizer assembly.

Denison Multipresses are used singly or in rows throughout the plant depending upon the complexity of the job. Operations include drawing, sizing, broaching, punching . . . and, of course, assembly.

Multipress contributes to fast, efficient production, with greatly improved quality an important benefit.

Datalog MUL-4 describes in detail the operations performed by Multipress for the SMP Company.

For a free copy, and for information on Denison's complete line of hydraulic Multipresses, write Denison Engineering Division, American Brake Shoe Co., 1164 Dublin Rd., Columbus 16, Ohio.

One 25-ton and five 15-ton Denison hydraulic Multipresses make up SMP's body press line . . . where rifle grenade bodies are progressively drawn to cone shape with flat end.

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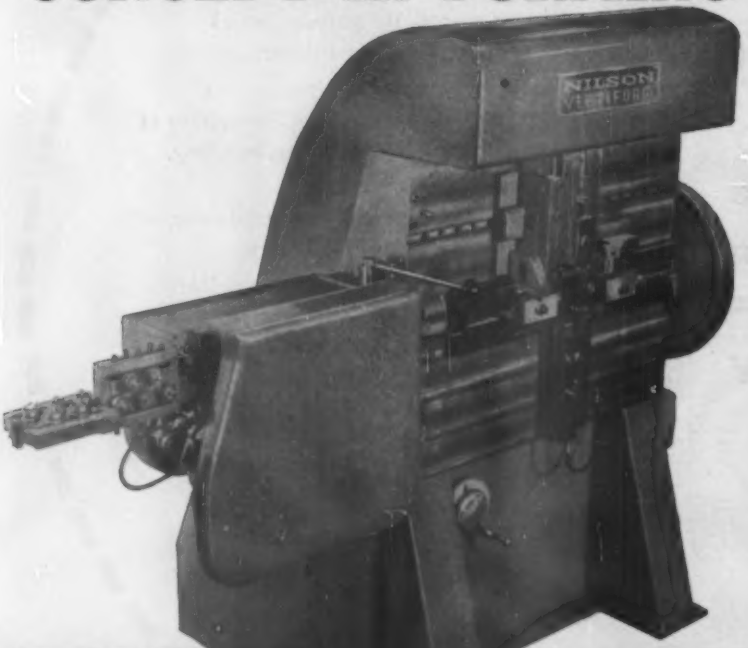

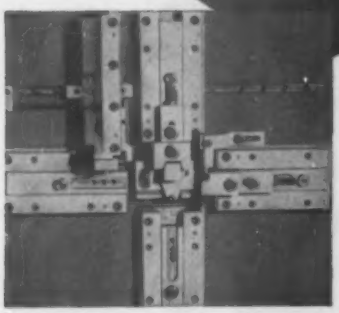

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The NEW AMERICAN MACHINIST'S HANDBOOK

Edited by
RUPERT LE GRAND
Senior Associate Editor, *American Machinist*
Based upon earlier editions of
AMERICAN MACHINISTS' HANDBOOK
edited by Fred H. Colvin and Frank A. Stanley
1579 pp. 5⅜ x 8, 774 illus., $11.00

Here's the biggest news in years for machinists, toolmakers, apprentices, designers, engineers, inspectors—in fact *all* in the metal working industry. Now you can have the on-the-job help of an *amazingly improved, fully-up-to-date*, NEW AMERICAN MACHINIST'S HANDBOOK.

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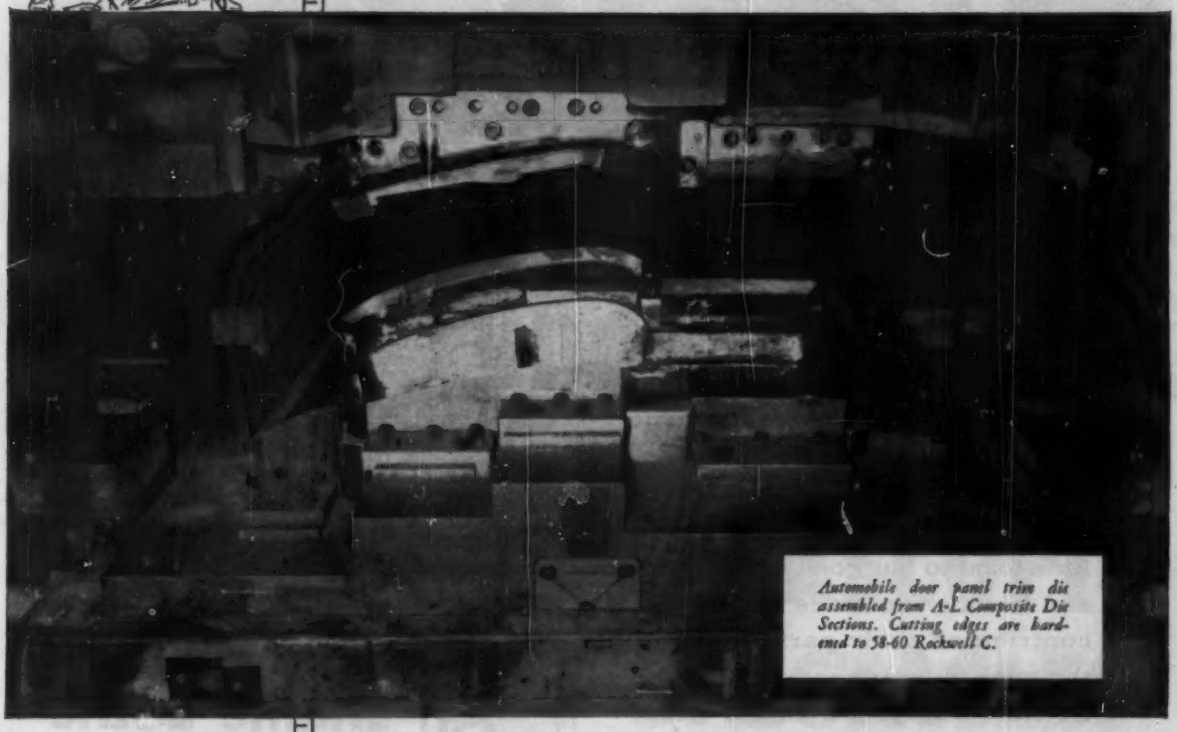

Automobile door panel trim die assembled from A-L Composite Die Sections. Cutting edges are hardened to 58-60 Rockwell C.

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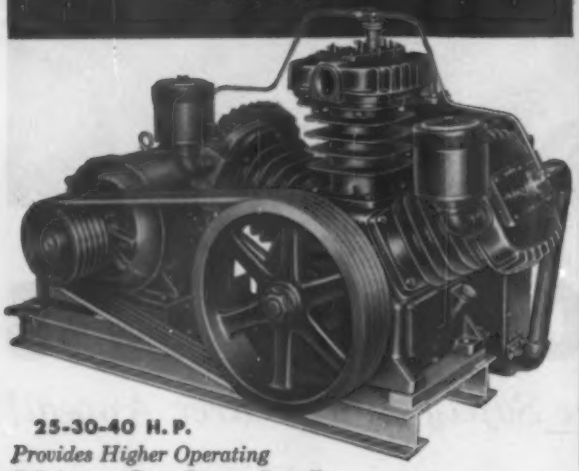

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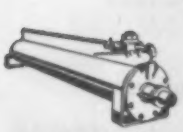

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Other Strokes Available	1½"-2" 2½"-3"	1½"-2" 2½"-3"	1½"-2" 2½"-3"
Shut Height for above strokes	7½"-7" 6½"-6"	10½"-10" 9½"-9"	13½"-13" 12½"-12"
Area of Bed front to back and left to right	8" x 11"	8" x 11"	8" x 11"
Bolster Plate Thickness	1"	1"	1"
Adjustment of Slide	1½"	1½"	1½"
Hole in Slide for Punch Shank	1⅜"	1⅜"	1⅜"
Center of Slide to Frame	12"	12"	12"
Flywheel Diameter and Face	18" x 3½"	18" x 3½"	18" x 3½"
Flywheel Weight (Approx.)	125#	125#	125#
Strokes per Minute	180-190	180-190	180-190
Motor H.P. and Speed	¾ HP 1140 RPM	¾ HP 1140 RPM	¾ HP 1140 RPM
Distance from Floor to Bed (Floor Models)	32½"	32½"	32½"
Distance from Bed to Center of Shaft	19¼"	22¼"	25¼"
Floor. Space FB × RL	20" x 35¼"	20" x 35¼"	20" x 35¼"
Overall Height	62⅛"	65⅛"	68⅛"
Size Opening through Back	5"	5"	5"
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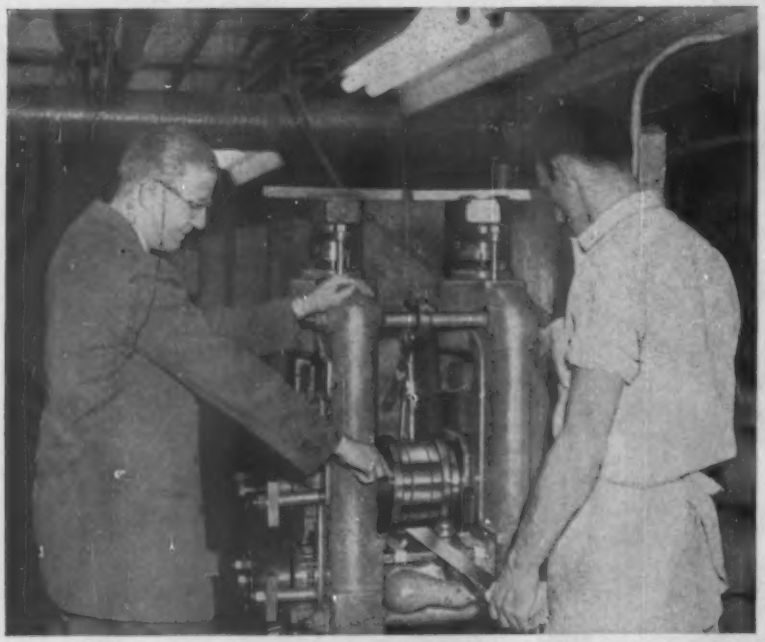

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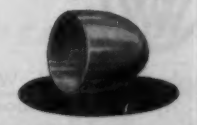
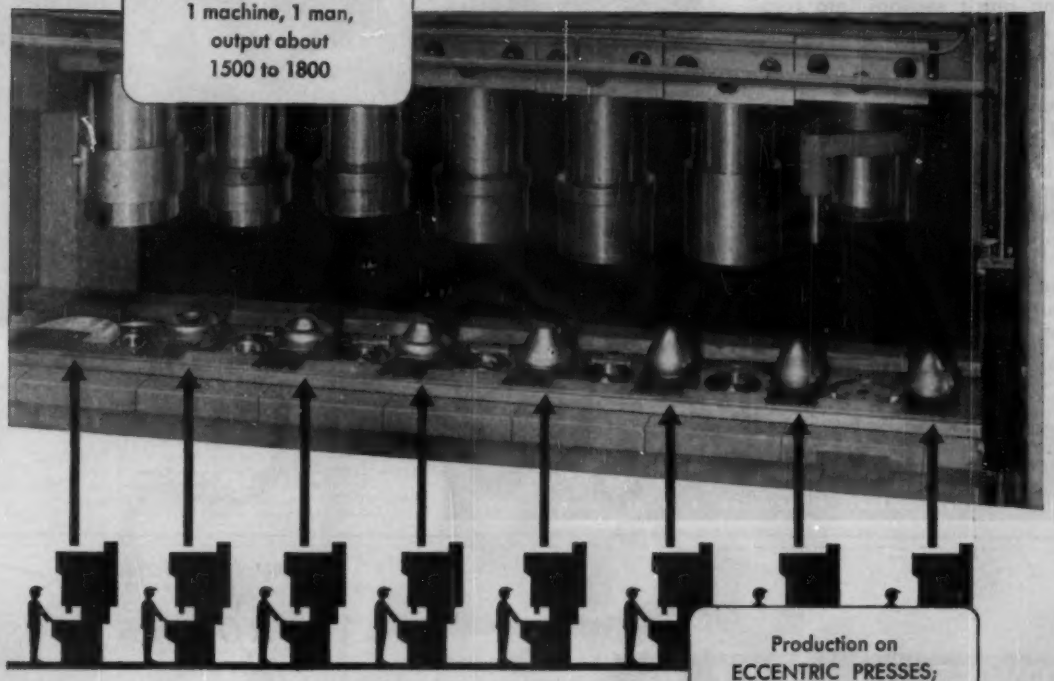
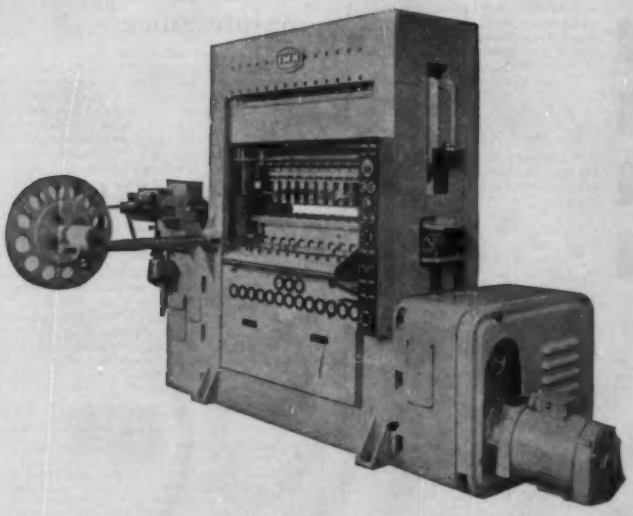
Example: Manufacture of headlight housings (3½ in. diameter)



Production on TRANSFER PRESS; 1 machine, 1 man, output about 1500 to 1800



Production on ECCENTRIC PRESSES; 8 machines, 8 men, output about 420 per hr.



The IWK Transfer Press requires only a short setup time. It is therefore very economical for short runs, too.

A complete catalog showing other practical examples is available upon request.

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GERMANY

Verson Transmat Presses, Verson Allsteel Press Co., Chicago 19, Illinois, U. S. A.

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The photograph illustrates a WILLIAMS-WHITE Hydraulic Bulldozer bending angle sections into complete circles as an initial step in the production of blade circle assemblies for use on road scrapers. The completed ring with gear inserted is shown at right in photo.

This is another example of the versatility of WILLIAMS-WHITE Hydraulic Bulldozers, available in capacities from 50 through 500 tons. For full information regarding these or other machines built to your specifications, write us or one of our representatives.

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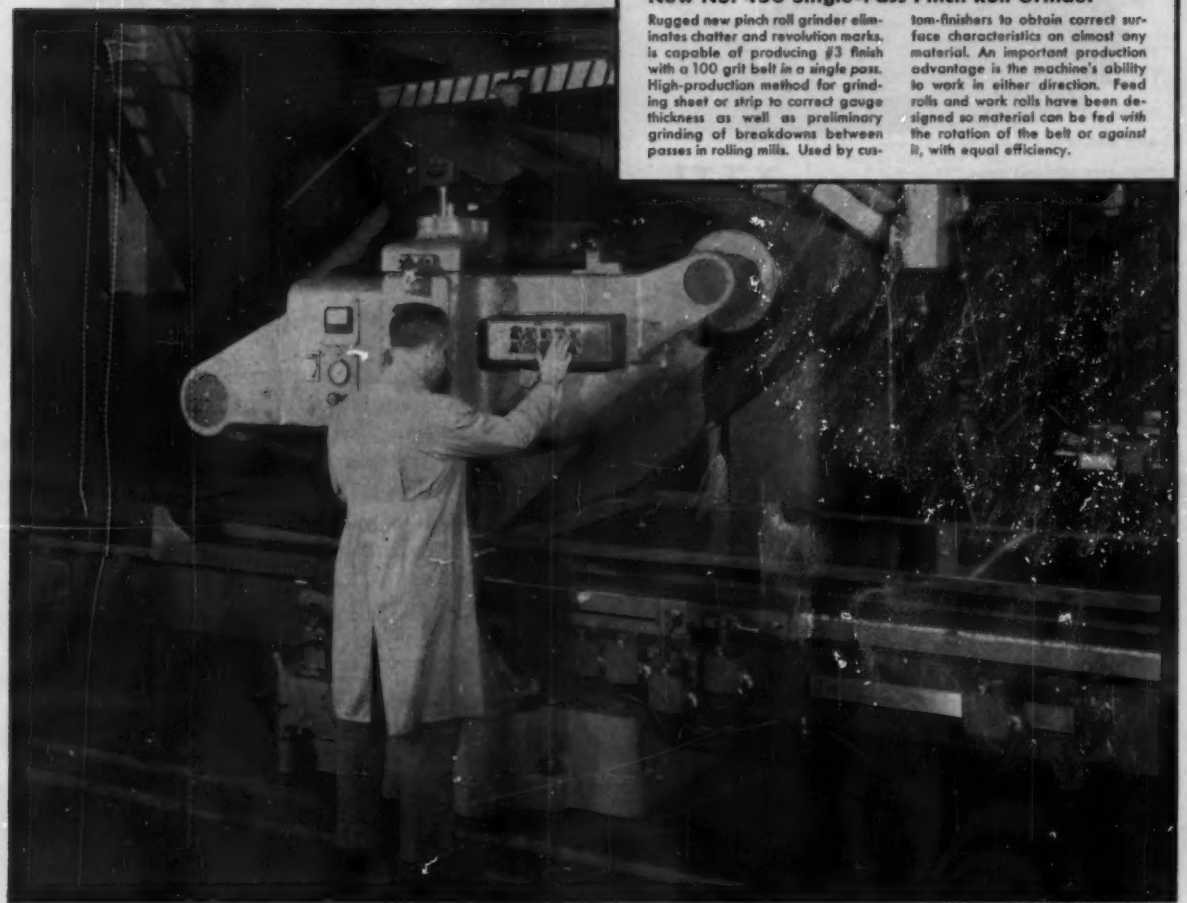

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SEARCHLIGHT SECTION

THE SURPLUS MACHINERY MARKET

• **The mild pickup in used machinery business** reported in the last issue has shown no signs of increasing, but neither has it decreased in the last couple of weeks. This leaves business considerably better than it was during the late summer months, but still without much real vigor.

Almost all buying activity at the moment stems from the medium-to-large shops, while smaller shops are keeping a tight hold on their wallets.

• **In Cleveland, for instance,** there have been quite a few layoffs in metalworking shops, while tool and die people say business is off 10 to 15% from midsummer levels. A business climate like that is naturally not conducive to purchase of machine tools, new or used, by the smaller shops.

One Cleveland firm reports that its Cleveland-area business has been holding up fairly well, but that its downstate business has "dropped to zero."

This company does not feel that price is a major factor in the present market, rather that those shops which are busy are buying machinery as needed, the others are waiting until things look up.

Another Midwestern used machinery dealer says that its business has leveled off at about 20% above that of late summer, with most activity centered in purchase of large machines by large shops. Small machines and small shops, this firm says, are both dragging.

Another Midwest outfit, which a few months ago predicted a decided pickup by this time, says it has failed to materialize and that the used machinery business is frankly "limping."

Needed, says the owner of this firm, is a general improvement in the manufacturing system, and the most logical way to achieve it is to increase defense spending, rather than cut it back.

This company now predicts such an improvement will come along in about three or four months. Meanwhile "the small shops seem to have run out of business and activity in the larger shops is very spotty."

• **West Coast used machinery sales have been hard hit** by aircraft industry changeovers and cutbacks.

Of the little activity that does exist out there, about 25% of sales are to electronics firms engaged in research and development. The rest comes from manufacturers engaged in civilian goods production, who are doing some buying of light vertical mills, standard lathes, heavy millers.

The number of West Coast auctions is up sharply, indicating that the small defense-dependent shop is unable to hold out until defense work picks up again. Dealers say they repossessed more equipment in November than at any time in years.

West Coast dealers are very bitter toward the administration's cutback policies. One hopes the missile program will assume some definite direction by January and things will pick up. Another sees no hope for improvement until after the 1958 Congressional elections. But any pickup that does occur is going to come too late to save the small ($100,000-or-less capitalization) job shops. They already have their backs to the wall, and West Coast dealers say that the first of the year will bring a sharp rise in bankruptcies.

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CINCINNATI 1066 horizontal 2-way, 1948
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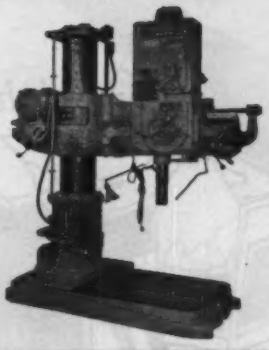

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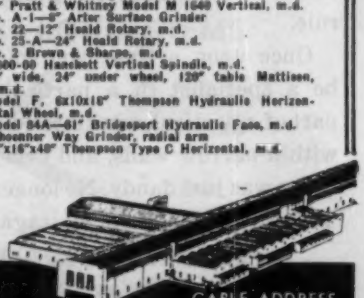

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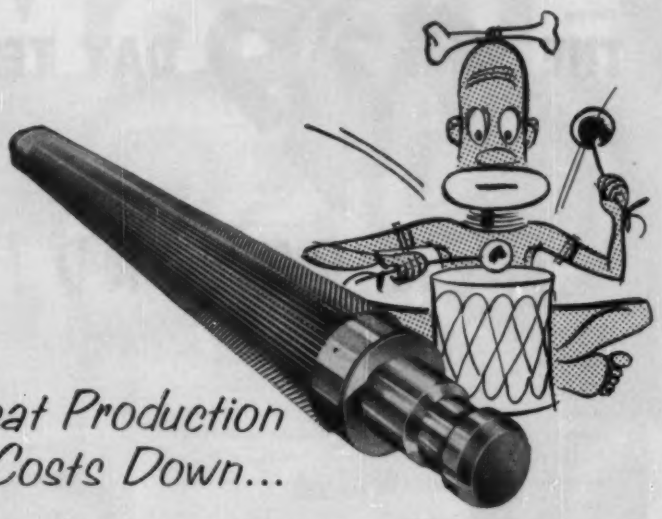

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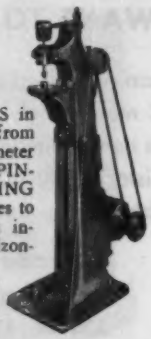

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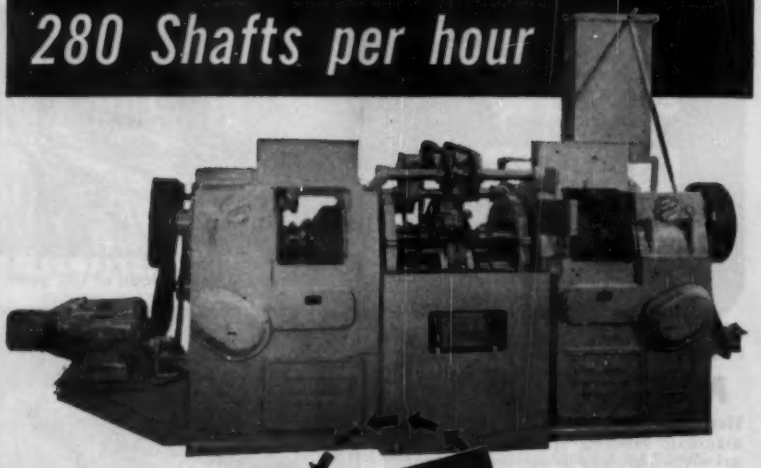

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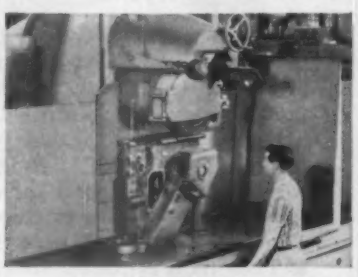

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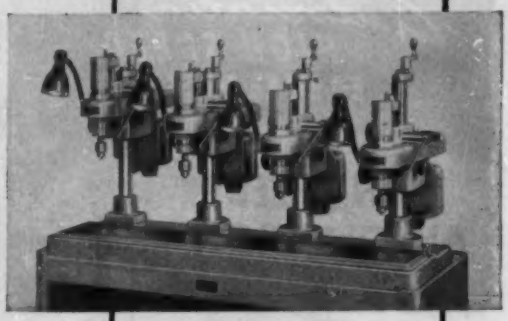

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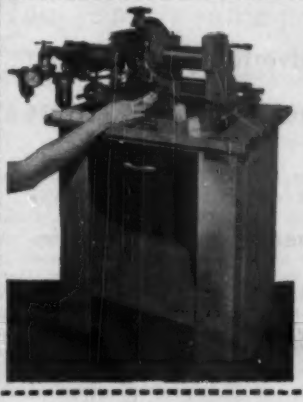

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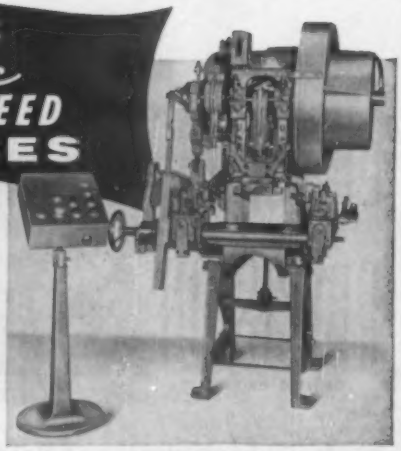

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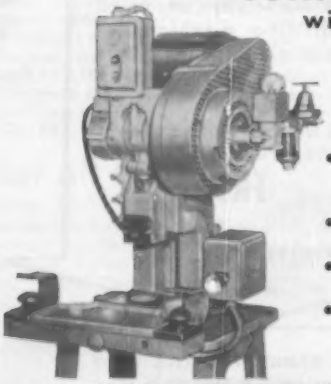

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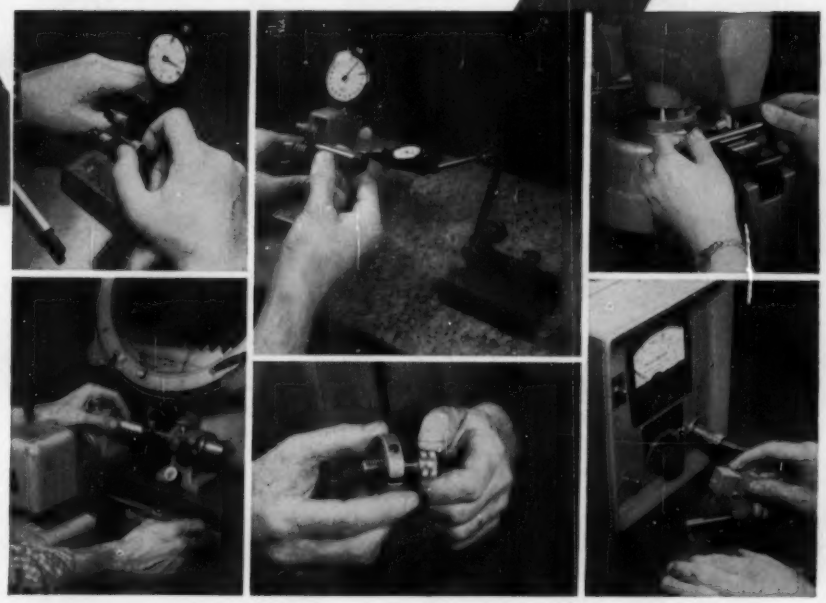

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